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PICKS and SHOVELS

By O. E. POTTER

Hell Hath No Fury—

"Like a woman scorned" is, I believe, the usual ending to the quotation but a North Carolina contractor discovered that a railway official whose signal system had been interfered with might outdo the scorned female. It all happened this way, according to a recent issue of *The Road Machinery News.*

The contractor needed a telephone for his field office and the best approach seemed to be running a wire through a metal tube under the Southern Railroad main-line tracks. This was done, the telephone put in service and everything worked perfectly.

Everything, that is, but the trains on the Southern Railroad. For suddenly every railroad engineer between Salisbury and Charlotte found himself staring into a red block light. And after some investigation, the contractor found himself staring at an irate railway official. The trouble was all due to the fact that the telephone had shorted the railroad's automatic signal system.

When the situation was explained and the contractor was able to work in a few words between the railroad official's explosions about molesting the trains on his line, everything was straightened out and there were no hard feelings. But it was all very confusing for a time.

U. S. Shows 'Em How

One of the interesting points brought out in "World Highway Progress," the report of the Highways Committee of the Automobile Manufacturers Association recently published, is the fact that the United States has led the way in road construction and the rest of the world has followed in her footsteps. Although the actual problems in other countries of the world differ greatly from ours, a careful study of road-building methods seems to indicate that

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Road Stabilized With Dry Cement

Experimental Section on 3.3 Miles of Heavy-Traffic Secondary Road Built in Wisconsin in 1936

By GUY H. LARSON, Assistant Engineer of Materials, State Highway Commission of Wisconsin

(Photo on page 44)

A NEW method of stabilizing road soils, using portland cement as a stabilizing agent, is receiving considerable attention. Briefly, the process is to scarify and pulverize the road soil, mix dry cement with the pulverized soil, then moisten and compact the mass, and finally roll and finish it to the desired shape and smoothness.

In 1936, Wisconsin, among several other states, undertook to build an experimental project of this type of road. The project was 3.3 miles in length, 1.65 miles of which were completed that fall. The project is located on State Highway 13, immediately north of Friendship, the county seat of Adams County. This region is an old glacial lake bed, and the soil found on the new grade was extremely sandy and graded largely be-

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Penetration Surface On Sand-Filled Base Smooth-Running Job

(Photos on page 44)

Methods and Equipment Used by Suzio Constr. Co. On 4.11-Mile Contract at Sharon, Conn.

THE northwestern corner of Connecticut ranks high in scenic beauty, attracting many tourists to see its high hills and lakes. During the spring of 1937 the Connecticut State Highway Department improved 8 miles of highway running north and east of Sharon, Conn., with a sand-filled macadam base and a penetration macadam top. The northern section of 4.11 miles was awarded to L. Suzio Construction Co., of Meriden, Conn., on its bid of $101,211.39.

As the road had been graded under a previous contract, only slight grading was necessary, but, to improve the drainage of the roadway to provide a firm foundation for the sand-filled macadam base, over 2,300 feet of Armco corrugated bituminous-coated perforated pipe was laid, mostly parallel to the center line of the road. The cuts were generally from 3 to 5 inches deep, with the exception of one long cut at the north end of the job. All of the grading was done by a 6-yard hydraulically operated Gar Wood scraper pulled by a T-40 TracTracTor followed by a Warco power grader to finish the surface. No power shovel was used on the job. A small amount of gravel base was placed on the old gravel road where it was felt that the foundation was too thin to support the heavy traffic expected. Work started on April 1, 1937.

Quarried Stone

The contractor owns three large quarries in Connecticut, from two of which, one in Meriden and the other at Woodbury, crushed stone was shipped for this job. The stone from the Meriden quarry was shipped by rail to Cornwall Bridge about 0.5 mile dead haul from the job. An ingenious method of unloading the hopper-bottom freight cars made use of an old granite arched culvert. The stream bed was excavated at the center and a 24-inch corrugated culvert pipe laid and backfilled to about 6 inches over the top with crushed stone. The width of the granite arched culvert and its height was just sufficient to permit the fleet of eight 6-wheel Ford and the International trucks to back, one at a time, under the arch and be loaded direct from a small track hopper suspended between the rails. Other stone was hauled 33 miles by the contractor's own fleet of Sterling trucks from Woodbury, Conn.

Sand-Filled Base

The 2½-inch base stone was laid down 21 feet wide from the hauling trucks by two 10-foot Burch spreaders, each handling half the road and kept quite close together. Two men took care of hitching the spreaders to the trucks and three laborers with stone forks did the small amount of necessary dressing, particularly along the center line and in spreading the extra 6 inches of the base at either side of the roadway. The base was thoroughly rolled with two 12-ton Buffalo-Springfield rollers until it had compacted to 3 inches.

(Continued on page 31)

Rotaries and Radios Fight Snow in Oregon

By HENRY W. YOUNG

(Photos on page 44)

Only Careful Planning and Good Organization Made It Possible to Lick Storms of Last Winter

THE Oregon State Highway Commission had its hands full fighting snow on its 6,700 miles of road last winter, the most severe winter in that respect in the history of the department. Roads were blocked more than ever before, and as late as the first of May extensive snow removal operations were going on in the mountains, several passes still being closed to traffic. At that time there was still 10 feet of snow in McKenzie Pass. This heavy snow called for $150,000 unusual expenditure for snow removal, an amount about equal to the total average yearly expenditure.

J. N. Bishop, Maintenance Engineer of the Oregon State Highway Commission, was interviewed for CONTRACTORS AND ENGINEERS MONTHLY on the work of his organization and particularly last winter's job of snow fighting.

Oregon, which is roughly 250 miles north and south by 300 miles east and west, has four fairly distinct kinds of climate, that of the high plateaus of the east, of the Cascade and Coast Range Mountain chains which run north and south, of the long Willamette Valley which lies between them, and of the coastal fringe, which results in four different types of snow removal problems. The work is handled by an organization within the Maintenance Department. This organization consists of: one maintenance engineer; one assistant maintenance engineer; five division engineers; fifteen district maintenance superintendents; 118 section foremen; 1,200 to 1,500 men in seasons of extreme snow. Four equipment shops are maintained in various parts of the state for repairs and maintenance.

Radio Coordinates Activities

Fortunately, radio facilities had been provided the previous year, and were of great aid during the 1937 storms. There are twenty-four broadcasting stations in the state, operated by the highway department, fourteen being fixed and ten portable and mobile. Three are of 1,000-watt capacity, seven of 50-watt and fourteen are 10-watt. All are operated on a short wave, 1,706 frequency.

The stations report regularly, and from these reports a general daily re-

(Continued on page 15)

Oregon State Hwy. Dept. Photo.

A Snogo in a Big Drift, Nearly 15 Feet High, at the East End of Frog Lake, Ore.

Features of Grading West Virginia Road

Channel Change, Culvert Construction and Full Cost Accounting on a Pinnell & Pfost Job

USING a 2½-yard gas shovel instead of a dragline because they wanted to save one piece of equipment on the job, Pinnell & Pfost of Ripley, W. Va., moved 43,000 yards of material in two lifts on a channel change at the east end of PWS project 847-B between Farmington and Mannington, W. Va. Half the material to be moved was a quicksand into which a man would sink to his knee an instant after he stepped onto it. Other contractors might have moved in a dragline but Pinnell & Pfost had faith that their Northwest shovel, which was slated to tackle every other kind of excavation on the job, would walk through the soft stuff as well.

The Channel Change

A 5 x 5-foot floating-type box culvert 92 feet long was to be built to take care of the flow of a small stream but that stream had to be diverted from its old bed as a part of the work. The 2½-yard Northwest shovel powered with a Twin City 120-hp gas engine made a 7-foot cut to start the diversion and this material was dry and firm. The second lift of about the same depth was not so easy. The mats that had been brought up from Ripley for the work proved too small, so a new set of 3 x 8-inch lumber laid on edge were made and even these disappeared into the quicksand so that only the tops of the crawlers were in sight at times. The spread of the weight of the shovel was such that the ground pressure on the mats was 4 pounds per square inch.

The wet material was put up on a bench to dry out and hauling was continued over the fill at all times until a series of heavy rains put the entire grade out of service. The contractor maintains that if a dragline had been used the dry and wet material would have been mixed so that it would have been impossible to haul over this section of fill. As it was, a fleet of four International 1½-ton and one Chevrolet truck worked over the fill throughout the work until the crawler wagons arrived.

At the upper end of the channel change a 16-inch natural gas line, a main trunk line into Pittsburgh, carrying 150 pounds pressure, had to be moved. The steel line with cast iron couplings was 40 years old, being one of the oldest from this famous gas and oil field, the Wolf Summit anticline. Wherever the new line crosses the road, the Pittsburgh & West Virginia Gas Co. put in a 20-inch steel pipe as a sleeve and ran the new 16-inch line through it.

Building Big Culverts

About 2,000 feet from the west end of the 3.352-mile grading project one of the large culverts was installed. It is a 5 x 10-foot box 145 feet long with the foundation carried 1 foot into rock. The quantities for this particular culvert are:

Unclassified excavation	120 cubic yards
Structure excavation	250 cubic yards
Class A concrete, 1:2:4	250 cubic yards
Reinforcing steel	54,400 pounds

The culvert has a 16-inch slab and walls with 1½ inches of concrete between the steel and face of the concrete. It is reinforced with 1-inch steel to carry a 37-foot fill. Aggregate for the concrete was stockpiled close by on a wooden platform and where the stocks of sand and gravel intermingled the material had to be discarded. Two men with wheelbarrows wheeled the stone to the C. S. Johnson wheelbarrow scales and two others handled the sand. The batches were given a 1½-minute mix in the Jaeger 2-bag mixer and then wheeled in buggies with one man pushing and two pulling up the runway to the top of the culvert forms. In addition to the four men on batching, there were one man handling the scales, another the mixer, and three men puddling.

PINNELL & PFOST

Project No. *Station No.* *Date*

DAILY DRILLING AND SHOOTING

	NO.	HRS.	RATE
Foreman			
Blaksmith			
Drillers			
Labor			
Powder Man			
Total			

SUPPLIES

Powder ..... lbs. at .....
Exploders No. ..... Length ..... at .....
Exploders No. ..... Length ..... at .....
Exploders No. ..... Length ..... at .....
Dynamite ..... lbs. at .....
Total .....

SUMMARY

Total Cost Supplies .....
Total Cost Labor .....
Total .....
No. Feet Drilled by Hammers .....
No. Feet Drilled by Wagon Drill .....

DAILY TIME REPORT

EMPLOYEE	HRS.	OCCUPATION

GENERAL INFORMATION

Weather Conditions, Etc .....

.....Foreman

One of the Daily Report Cards Used on Pinnell & Pfost Jobs

The forms were built up of 2 x 6-inch tongue and groove lumber with 2 x 4-inch struts on 2-foot centers and wales of double 2 x 6's carrying the tie rods. The runway on top was carried by 4 x 6's laid on the forms. The cantilever-type wing walls were cast separately with premoulded expansion joints between them and the box.

The cement for the culverts was furnished by the Standard Portland Cement Co. of Painesville, Ohio, the reinforcing steel was delivered by truck to the site of the culvert all cut, bent and bundled by the Fort Pitt Bridge Co. of Pittsburgh, Pa. All the form lumber was cut to size in the contractor's own mill at Ripley, W. Va.

Another large culvert measuring 6 x 10 feet and 192 feet long was installed on the job. It is similar in construction and design to the one described except that it has a floating bottom and the walls and slab are 21 inches thick because of the 52-foot fill it carries. In the section in which this culvert was installed there was a total of 116,000 cubic yards of excavation to move in 3,200 feet. The fill over the culvert contains 87,000 cubic yards.

Pushing the Cuts

The excavation on this contract was handled entirely by the 2½-yard Northwest shovel. The material was hauled away rapidly by two Athey 14-yard crawler wagons pulled by Caterpillar RD8 diesel tractors. There were also two Athey 8-yard crawler wagons pulled by Caterpillar Sixty gas tractors. There was never a minute of waiting when the four wagons were hauling away from the shovel and the operator always had a

(Continued on page 40)

Streamlined Shoulders Increase Road Safety

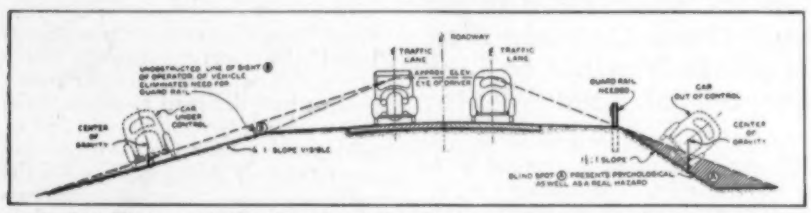
Grading Costs Balanced By Savings Effected in Reduced Need of Guard Rail in Many Places

By WILBUR H. SIMONSON,
Senior Landscape Architect,
U. S. Bureau of Public Roads

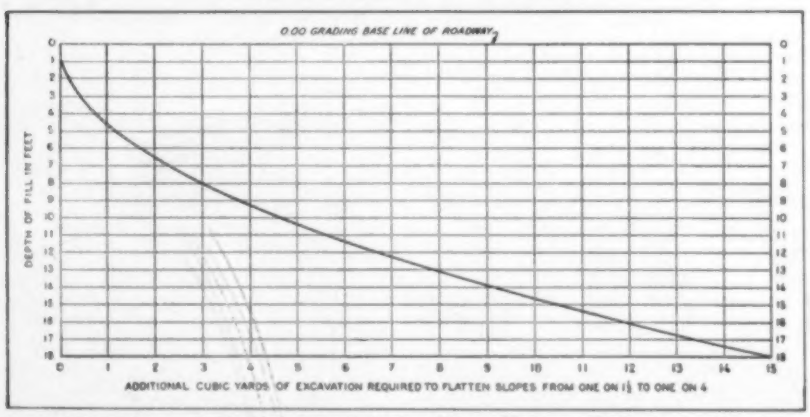
IT OFTEN may be economically advisable to flatten embankment slopes to 1 on 4 instead of constructing guard rails, provided right-of-way is available and existing trees or other desirable growth do not prevent. If the average installation of guard rail is assumed to cost about one dollar per linear foot and common excavation about 50 cents per cubic yard, it is more economical to flatten slopes of 1 on 1½ to 1 on 4 up to depths of about 7 feet than to use guard rail. The saving in cost of maintenance would increase this economic depth. Flattening slopes is especially desirable where the adjoining ground is free of other hazards, such as boulders or trees, so that by eliminating the guard rail a safer condition as a whole is created. Much of the guard rail used in the past could well be eliminated without a sacrifice of safety by more effectively utilizing the right-of-way of the highway in constructing flatter fill slopes of from 1 on 4 or 5, which the vehicle could utilize for emergency turnouts without danger of overturning.

Where the cost of installation of guard rail, capitalized, equals or exceeds the cost of flattening the earth shoulder slopes to the proper ratio or angle, such grading construction is economically desirable. The idea of landscape grading for highway safety is perhaps the latest

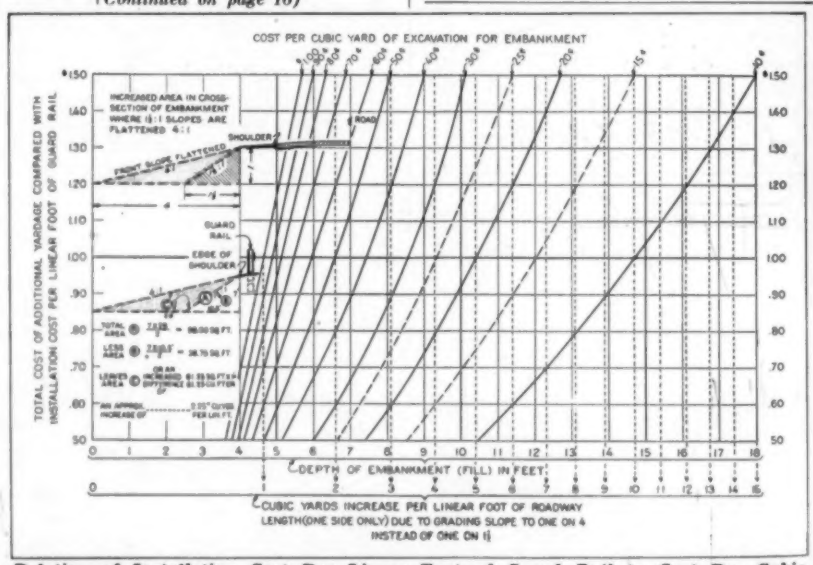
(Continued on page 16)


ROADWAY
TRAFFIC LANE
TRAFFIC LANE
UNOBSTRUCTED LINE OF SIGHT OF OPERATOR OF VEHICLE ELIMINATES NEED FOR GUARD RAIL
APPROX. ELEV. EYE OF DRIVER
GUARD RAIL NEEDED
CAR OUT OF CONTROL
CENTER OF GRAVITY
CAR UNDER CONTROL
CENTER OF GRAVITY
1:1 SLOPE VISIBLE
1½:1 SLOPE
BLIND SPOT (B) PRESENTS PSYCHOLOGICAL AS WELL AS A REAL HAZARD

A Typical Highway Section Showing (A) a Car in an Emergency, Out of Control on a Steep Slope with Blind Spots at the Foot of the Slope, Creating the Need of Guard Rail, and (B) Car More Readily Controlled on Flattened Slope, with Slope Fully Visible and No Need for Guard Rail.


0.00 GRADING BASE LINE OF ROADWAY
DEPTH OF FILL IN FEET
ADDITIONAL CUBIC YARDS OF EXCAVATION REQUIRED TO FLATTEN SLOPES FROM ONE ON 1½ TO ONE ON 4

Increased Volume of Grading Required Per Linear Foot of Highway on One Side Only to Grade Slope on 1 on 4 Instead of 1 on 1½. For Example, If Depth of Fill is 8 Feet, 3 Additional Cubic Yards of Fill Will Be Required.


COST PER CUBIC YARD OF EXCAVATION FOR EMBANKMENT
TOTAL COST OF ADDITIONAL YARDAGE COMPARED WITH INSTALLATION COST PER LINEAR FOOT OF GUARD RAIL
INCREASED AREA IN CROSS-SECTION OF EMBANKMENT WHERE 1½:1 SLOPES ARE FLATTENED 4:1
SHOULDER
ROAD
FRONT SLOPE FLATTENED
GUARD RAIL
EDGE OF SHOULDER
DEPTH OF EMBANKMENT (FILL) IN FEET
CUBIC YARDS INCREASE PER LINEAR FOOT OF ROADWAY LENGTH (ONE SIDE ONLY) DUE TO GRADING SLOPE TO ONE ON 4 INSTEAD OF ONE ON 1½

Relation of Installation Cost Per Linear Foot of Guard Rail to Cost Per Cubic Foot of Excavation for Embankment to Determine Economic Depth of Fill With Flattened Slope and Without Guard Rail. This Chart Shows the Cubic Yards Increase Per Linear Foot of Roadway Length, One Side Only, Due to Grading Slope to 1 on 4 Instead of 1 on 1½. When the Cost of Guard Rail Per Linear Foot Is Greater Than the Increased Cost of Flattened Slopes, Guard Rail May Be Omitted.

Forging another

23-MILE TEXACO LINK

into the

COLORADO STATE HIGHWAY SYSTEM

This battery of blade graders is engaged in mixing TEXACO Asphalt Surfacing Material and mineral aggregate on Colorado State Highway No. 185, north of Denver. Employing this "mass production" method, Colorado was able to complete the 23-mile Asphalt Road-Mix project in excellent time.

Inexpensive to construct and offering a resilient, tough and safe-riding surface, this TEXACO Road-Mix type of highway construction is ideal for a large portion of every State Highway System and also for most of the Secondary Road System.

Have a Texaco Field Man call and explain fully how this type of surface might be utilized under your conditions.

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Machines Return to Their Own

One of the truest signs that the depression is over is the increasing use of machines for the various operations on highway and other heavy construction which, during the last few years, were required to be done by hand by state and federal specifications.

The first evidence came as long ago as four years when we noted the absence of the flock of laborers dressing levees and found the work being done by tractor and bulldozer. Power subgraders on concrete paving contracts, form graders for road form trenches and the use of graders and bulldozers for all kinds of slopes and ditches have replaced hand labor.

Again it is the story of dropping a man here and another there by the installation of a machine to handle the work. For example, the vibrator along the forms on a concrete paving job does ten times the effective job that the two men cutting or spading along the forms can do. But it means the elimination of one of those men, as one man can handle the vibrator and the machine itself is usually set up on the finishing machine, or even run along the adjacent slab mounted on a rubber-tired wheelbarrow frame.

On a job in Missouri this summer we also noted the difficulty the contractor was having in getting men to run a tractor and a blade. He had to send over 100 miles for four men who had been released from another job. This is one of the explanations of the rise in the use of machines again for paving operations. Labor that wants to work and has not been spoiled by relief has found its outlet in the increasing activities in the construction and allied fields and therefore must be supplemented insofar as possible by effective, economical machines to perform the same operations.

Those "Men Working" Signs Again

We have maintained before in these columns that the promiscuous use of the "Men Working" signs by state highway departments is a hazard to the driving public. As warnings they are effective if the drivers of automobiles and trucks find that they mean something. Too frequently the signs are left along the roadside long after the men have moved ahead or to some other location off the road and the motorist becomes lax in heeding them.

On August 6, 1937, we had the first opportunity to witness the real effect of these signs when used to too great a degree. Driving east on U. S. 66 about 48 miles west of St. Louis, the road was marked on both ends of a repair job with "Slow" and "Men Working" signs. There had been a settling of the pavement at that point and a mud pump was at work raising the slabs. The work was on an S-curve in the main highway which, with the signs, should have been sufficient to cause a slowing up of traffic.

Such, however, was apparently not the case, for in spite of the added warning of "One Way Traffic" on another sign an automobile and a large truck tried to go through the needle's eye at the same time, resulting in an overturned truck which was driven too close to a fairly steep shoulder.

We had driven some 40 miles on U. S. 66 at the time and had noted several similar signs along the road and failed to see trucks entering or leaving the road or men working on or at the side of the highway, except in one instance where a grader and some men were working on the shoulder for a stretch of about a mile. These were also protected by the warning signs. This happens to be a concrete example of the careless use of signs against which we have preached from time to time. This time we have as a text an actual example from Missouri, but we do not wish to imply that this is the only state whose maintenance forces have sinned in this respect. It is universal. The excuse will be that it takes too much time to go back and remove the signs when the men and trucks leave the road for a short time. Perhaps it does, but the psychological effect on the driver in seeing so many signs that mean nothing is to create a disregard of their warning until it involves the vehicle and driver and some other vehicle and driver in an accident.

The drivers of the vehicles, of course, should be less callous in observing these signs, even though they mean nothing most of the time, but human nature being what it is, with the powder monkey still carrying electric caps and dynamite in the same truck, we must take every precaution to prevent the callous attitude. This is a real contribution that the State Highway Departments can make toward highway safety.

1001 Uses for Concrete

Concrete and its uses in the construction industry have become an accepted fact to contractors, engineers and others associated with the industry. However, there is much of interest and help even to those familiar with the conventional uses of concrete in a new book "1001 Ways to Use Concrete," by Harold O. Hayes, recently issued by the Popular Mechanics Press. Written for the layman and in the popular style, this book discusses not only new and varied ways of using concrete but also contains practical suggestions as to how to do it. For example, the book contains 146 "kinks" in using concrete, from handling it in cold weather to traveling exhibits to boost business.

Copies of this new book may be secured from the Popular Mechanics Press, 200 E. Ontario St., Chicago, Ill. Price: $5.00.

The most modern sleeping bus equipment to be found anywhere in the world is in regular service across the deserts between Damascus and Baghdad.

Roadside Mowing

The general practice by a majority of state highway departments is to mow and remove weeds along the roadsides in the fall during the yearly clean-up of the entire right-of-way, after the weeds have completed their growth, O. K. Normann, Assistant Highway Engineer, Division of Construction, U. S. Bureau of Public Roads, reports in a study of the control and eradication of weeds along roadsides in a recent issue of *Public Roads*. This clears the roadside of dead growth that might clog the ditches and culverts and cause formation of snowdrifts on the roadway during the winter and spring months, but helps very little in the control or permanent eradication of undesirable vegetation.

In addition to mowing over the entire right-of-way in the fall, the majority of state highway departments also mow over the shoulders one or more times during the growing season. A few mow over the entire right-of-way two or three times, the shoulders four to eight times, and supplement these mowings by hand cutting of weed patches as needed to keep seeds from maturing.

Equipment Used

The equipment used for the mowing operation includes truck or tractor-drawn hay mowers, power mowers, ordinary horse-drawn farm mowers, and hand scythes. When mechanical mowers are used, weeds around headwalls, guard rails, fences, signs, highway markers and other obstructions where the mechanical unit can not be used are cut by laborers using scythes.

The most effective type of mechanical mowing unit depends largely upon the width and roughness of the roadside to be cut over and the number of headwalls and other obstructions present. The type preferred by maintenance superintendents in a majority of states, especially when cutting over the entire right-of-way, seems to be the ordinary horse-drawn farm mower, because these units can be operated efficiently over comparatively rough ground and close to obstructions, they can be rented at reasonable rates in many of the localities where they are to be used, and they are economical to operate.

Mowers drawn by light trucks are very effective on shoulders and other places where there are few obstructions. Some states, however, prefer to use two mowers drawn by a light tractor as they have found that truck gears require frequent replacing when the truck is used continuously at speeds of 4 or 5 miles an hour. Also one man is able to operate a tractor and mower unit while two are usually required with a truck unit. Numerous self-propelled machines have been built by state forces for cutting roadside weeds. These include mowers attached to tractors with power take-offs and mowers attached to the side of a truck. Equipment manufacturers have also placed on the market several types of self-powered mowers especially designed for roadside work.

Costs of Mowing

Hourly rates for hired mowers, including two horses and the operator, varied from $0.60 to $1.00 during 1935 in the states that furnished cost data for the study made by the U. S. Bureau of Public Roads. The resulting costs varied from $1.20 to $2.43 for a round trip over a mile of highway, or $0.99 to $2.00 an acre. One state hiring mowers on a mileage basis paid $1.30 per round trip over one mile of old roads and $1.00 on roads recently graded where the cutting was easier because of modern design.

Hand mowing with labor at $0.40 an hour costs about $5.00 an acre. This is considerably higher than the cost of cutting with horse-drawn or engine-powered mowers. Some states prefer to use mechanical units on accessible sections first and then finish with hand scythes. Others prefer hand cutting around all obstructions, trees and desirable plants first, so that they will be in plain view of the operators of the mechanical units.

Typical Motorist Works Week to Pay Gas Taxes

The typical motorist in the United States rides forty 8-hour days each year in his automobile and works seven days, or more, to earn enough money to pay the gasoline taxes on the motor fuel he consumes, according to the American Petroleum Industries Committee.

Last year the typical motorist used 641 gallons of gasoline, on which he paid $30.93 in state and federal taxes. At 15 miles to a gallon, that gasoline provided 9,615 miles of travel. Figuring an average of 30 miles an hour, that mileage is equivalent to 320 hours, or forty 8-hour days. However, more than half of the motorists in the United States earn less than $1,500 a year, and the committee estimates that the typical American motorist must therefore work seven or more days to earn enough money to pay his gasoline taxes.

If this money is invested in highway construction and maintenance, the motorist gets value received for his money but if, as in many states, large sums of this money is diverted to other uses, then the typical motorist is quite justified in rising up with the shout "Stop, thief!" Perhaps if all the "typical motorists" will get together and shout loudly enough, their money will be invested where it should be—in the highways they use.

ARE YOU PREPARED FOR THIS?

Drifts Such as These on a Highway in Douglas County, Nebraska, May be Waiting for You This Winter. To Keep Your Roads Open to Traffic During the Winter Months, Your Equipment Must Be Put in Readiness Now.

New Ransome Dealers

The following distributors have been appointed by the Ransome Concrete Machinery Co., Dunellen, N. J., to handle its line of concrete mixing and handling equipment: Charles L. Hillis, 215 16th Ave., N.E., St. Petersburg, Fla.; Dixie Equipment Co., Selma, Ala.; Morgans, Inc., Savannah, Ga.; Julien P. Benjamin, Inc., Jacksonville, Fla.; Contractors Supply Co., Waterbury, Conn.; Manufacturers Supply Co., 711 Blount Bldg., Pensacola, Fla.; Meriwether Supply Corp., 1312 Jordan St., Shreveport, La.; Smoot Machinery Co., 46-50 W. Fourth St., Salt Lake City, Utah; Mine & Smelter Co., El Paso, Texas; and Dominion Distributors Co., Mitchell Bldg., St. John's, Newfoundland.

Deere Purchases Killefer

Announcement has been made by Deere & Co., Moline, Ill., of the purchase of the Killefer Mfg. Corp. plant in Los Angeles, Calif. The acquisition of the Killefer factory, the products of which are mainly heavy-duty farm and road-building equipment, gives Deere & Co. the additional facilities needed to keep pace with its rapidly expanding business in the Pacific Coast territory.

It is the intention of the company to operate the business of the Killefer Mfg. Corp. substantially as it has been in the past, with no changes in personnel. O. P. Robb, who has been Vice President and General Sales Manager for many years, will continue in that capacity.

Lansing Plant Back to Normal

The Lansing Co., Lansing, Mich., manufacturer of a complete line of concrete mixers, wheelbarrows, gasoline tractors, trailer and hand trucks, has announced that its plant is now back to normal and is making prompt shipment of orders, after a brief sit-down strike at its plant in July.

Can you get all of these shovel and crane features?

LOOK over the other machines having ratings equivalent to the smaller Northwests—⅜, ½, ⅝ and ¾ cu. yd. capacity, or for that matter *any* size.

No other shovel, crane, dragline, pullshovel or skimmer offers you such a combination of features or is built to such quality standards.

These features mean faster, easier handling, longer machine life, lower operating costs, lower maintenance cost, easier travel and increased output, and less operating time lost.

All this you have at very little more cost than the ordinary machine. When the finest costs so little more, why not have it?

NORTHWEST ENGINEERING CO.
1730 Steger Bldg. 28 E. Jackson Blvd.
Chicago, Illinois

- Greater engine power for harder work.
- "Feather-touch" clutch control.
- Cushion clutch.
- Helical gear drive.
- Adjustable hook rollers.
- Cast steel bases.
- Ball and roller bearings on all high speed shafts.
- Ventilated uniform pressure swing clutches.
- Self-cleaning crawlers.
- Two speed travel.
- Northwest welded shovel boom and dipper sticks.
- Northwest gives you a combination of the simple Northwest independent crowd plus additional power for crowding that other shovels waste.
- Find out about these features. They will mean money in your pocket.

NORTHWEST

Cribbing and Piles Of Treated Timber

South Dakota Highway Dept. Uses Creosoted Timber Cribs At Overpass and Similar Timber for Piles

CREOSOTED timber cribs have been used recently by the South Dakota State Highway Department as retaining walls at the sites of several overpasses where the toe of the slope, unless restrained, would encroach on the clearance desired for the railroad tracks. By thus shortening the slope of the high head-of-bank, the length of the overhead structure is also shortened.

The recently completed crossing at Roscoe over the main line of the Chicago, Milwaukee, St. Paul & Pacific RR is one case where creosoted cribbing was installed. The center line of the highway intersects that of the tracks at an angle of 25 degrees. The overhead structure consists of seven steel beam spans of lengths ranging from 42 to 52 feet each. The three center spans are so arranged as to clear the one existing track and a proposed future track. Interior bents are supported on steel columns founded on masonry pedestals. These pedestals and the concrete abutments have their footings 6 feet below the ground surface and are supported on pressure-creosoted timber piles, treated in accordance with standard specifications of the South Dakota State Highway Department. Creosote treatment was necessary for these piles, since the cut-off is well above the line of permanent saturation. The piles were 16 feet long and 144 were required.

Timber Cribbing

The plans for the cribbing required that the face, or front, be founded upon a double row of 10 x 10-inch x 16-foot mud sills over 12 x 12-inch x 3-foot grillage blocks set on 4-foot centers, and the rear upon one line of 8 x 8-inch sills. The face height here is 14 feet, inclined back at a batter of 2 in 12. The standard interior front and rear stretchers are 8 x 10-inch x 16 feet and 8 x 8-inch x 16 feet respectively, supported on 8 x 8-inch headers spaced 8 feet apart. The bottom headers are 12 feet long and those on top are 3 feet 3 inches.

The timber specified for this cribbing was southern pine of 1,000-pound grade, or an equivalent grade of Douglas fir, complying with the approved grading rules of the American Association of State Highway Officials for such timber. The individual pieces were framed and bored before treatment. They were treated with 8 pounds of Grade One creosote per cubic foot by an empty-cell process.

The crib filling was compacted earth and was placed in 16-inch layers, each layer being thoroughly tamped before placing the next one.

The plans for this overhead structure and cribbing were drawn under the direction of Kenneth R. Scurr, Bridge Engineer of the South Dakota State Highway Department.

—From the *Wood Preserving News* of the American Wood-Preservers' Association.

Creosoted Timber Cribbing Used to Retain the Bridge Ends and Fill Slopes On the New Highway Bridge at Roscoe, South Dakota.

Pocket Reference Book On Asphalt Construction

The Sixth Edition of "Asphalt Pocket Reference for Highway Engineers" written by Prevost Hubbard, Chemical Engineer, and Bernard E. Gray, Chief Highway Engineer, The Asphalt Institute, 801 Second Ave., New York City, was issued on June 1. Its seventeen chapters, containing 240 pages, comprise a comprehensive handbook of all phases of asphalt highway construction and maintenance, joint filling and bedding courses for brick paving, bridge floors and track construction, tennis courts, sidewalks and playgrounds, airports, asphalt revetment and jetty construction and a series of useful tables for the highway engineer.

The book, only 3/8 inch thick and with a thick flexible leather-finished binding, makes a handy volume easily carried. Copies of this Pocket Reference Manual will be sent to our readers without charge upon request to this magazine, or to The Asphalt Institute, 801 Second Ave., New York City, and mentioning CONTRACTORS AND ENGINEERS MONTHLY.

A New Blade Grader

A new Model 33 blade grader, similar in general design to the Caterpillar No. 44 and 66 graders recently added to its line, has been announced by the Caterpillar Tractor Co., Peoria, Ill. This machine, which has a standard 8-foot blade and weighs 5,900 pounds, offers unusual flexibility and rapidity of blade movement, according to the manufacturer. The blade can be moved from a ditching to a high-bank cutting position without offsetting the blade on the beams or making any changes in the supporting links and without the operator leaving his platform or stopping the tractor.

The No. 33 grader is designed for operation with a Caterpillar RD4 diesel tractor or other tractors of approximately 35 drawbar horsepower.

NOW!
SKIP-PIPE
FOR SUB-DRAINAGE
A Cast-Iron Under-Drain Pipe constructed on an entirely new principle that is creating the keenest interest among engineers and public works departments. After exacting tests conducted under field conditions, these results have been thoroughly established:
Operates by gravity flow and not by hydrostatic pressure: It builds up no head.
Utilizes maximum capacity: Perforated Pipe never utilizes more than 60 per cent of capacity.
Takes off from 2½ to 3 times as much water in a given time as Perforated Corrugated Steel Pipe.
Begins draining much sooner than Perforated Pipe.
Finishes draining long before Perforated Pipe.
Lasts indefinitely — almost as long as virgin ore.
Is easily laid, or replaced: Clogging is very improbable under any conditions.
SLOPING CRADLE INVERT PIPE
PATENTED U. S. A.
SKIP PIPE
THE MODERN WAY
DIMICK-MOSHER PRODUCTS COMPANY
120 BOYLSTON STREET, BOSTON, MASSACHUSETTS

Emulsion and Chips Create Non-Skid Top

State Maintenance Crews Take the Skid Out of Fat Asphalt Pavement on U. S. 99 in California

MANY of the older asphalt pavements laid in the San Joaquin Valley in California in past years have been too rich in asphalt for the high summer temperatures which range around 117 degrees in the shade. These pavements laid in 1924 and 1925 had 7 to 9 per cent asphalt and were slippery when there was the least moisture in the air. A method was developed by the Maintenance Division which has proved satisfactory in overcoming the increase of asphalt in the top of the pavement.

A chisel-tooth planer consisting of a heavy structural steel body, with a wheelbase of 20 feet, to iron out irregularities in the pavement, carries cutter blades or chisels about 2½ inches wide and shaped like flattened J's. These chisels are staggered so that more than one trip over the surface is required to make a clean cut the width of the machine. A blade under the body and back of the chisels moves the material cut from the surface to the side. On the section immediately north of Bakersfield on U.S. 99 in Kern County this fat material was bladed to the shoulder and incorporated with the oiled shoulder by adding some dirt and mixing with a blade, forming an excellent 4-foot shoulder. Only ¼-inch of the material was cut from the top of the road as this was found to be the portion that had most of the excess asphalt.

Tack Coat and Chips Keyed In

As soon as the planer had completed its operations a tack coat of emulsified asphalt consisting of 55 per cent of 90-95 liquid asphalt and 45 per cent water was applied at the rate of ⅛-gallon per square yard. Immediately behind the distributor and before the emulsion had a chance to break, a chip spreader was backed onto the tack coat, spreading ½ to ¾-inch clean rock at the rate of 25 to 30 pounds per square yard. Either a rotating disc spreader or a vane-type spreader is used for this work. When the non-skid material is applied to a concrete shoulder ⅓ gallon of the emulsion is used to make the chips stick.

Immediately after the spreading of the chips a 5 or 6-ton roller is run over the section to key the chips to the old pavement. This work is always done in the hottest weather to insure the maximum amount of chips sticking to the asphalt. Traffic is kept off the road until the rolling is completed. Following the first rolling a gang broom is dragged over the surface to distribute any loose chips uniformly over the surface and the following day the road is rolled again to complete the keying.

C. & E. M. Photo

Non-Skid Top on Old Asphaltic Concrete Surface.

New Asphalt Mixer With Diesel Power

The application of diesel power to construction equipment is increasing rapidly and the latest innovation is an asphalt mixer with a diesel engine. The Iowa Mfg. Co., Cedar Rapids, Iowa, has recently announced a traveling road-mix plant for which a Model 6-LD-909 Buda diesel engine, made by the Buda Co., Harvey, Ill., furnishes the power.

The plant is mounted on twelve pneumatic tires with a walking beam rear wheel arrangement to assure positive traction for the rear wheels at all times, regardless of roadbed irregularities. All four rear wheels are equipped with Bendix brakes. It has a 1,000-gallon supply tank, equipped with kerosene pressure burners for maintaining even temperatures of the bitumen in the tank during operation. The aggregate batcher is synchronized with the asphaltic-material measuring pump and operations are so regulated that the materials are mixed in the proper proportions.

The Buda diesel engine used to power this plant is a 6-cylinder model with a 5¼-inch bore, 7-inch stroke and 909-cubic inch displacement. This engine uses the "controlled-turbulence" combustion system, a regular feature of Buda diesels. This same model is being used by many other manufacturers for various types of construction and road-building equipment.

The New Iowa Traveling Road-Mix Plant, Equipped with a Buda Diesel Engine.

Complete information on this new road mix plant may be secured from the Iowa Mfg. Co., and on this and other types of Buda diesel engines for construction equipment from the Buda Co., by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

New Compressor Factory Completed by Schramm

A new 25,000-square foot factory addition for Schramm, Inc., manufacturer of air compressors, West Chester, Pa., was completed on September 1. The new structure adjoins the present factory and office building and is of brick, glass and steel construction. The entire facilities of the new factory will be devoted to the manufacture of the new Utility line of compressors.

Schramm, Inc., has occupied its present site for the past 18 of its 37 business years, having moved to West Chester in 1919 when increased business in those days called for similar expansion.

LINK-BELT

Speed-o-Matic SHOVEL DRAGLINE-CRANE

Banishes Operator Fatigue!

● The operator's physical capacity limits the yardage handled per day, not the mechanical capacity of the machine.

Speed-o-Matic eliminates operator fatigue because it transfers the work of operation to the power of the machine itself. Short, easy, wrist motions move the control handles; foot pedals are operated from a sitting position.

Compare this ease of operation with the physical effort required to manipulate mechanical hand-lever machines which tire the operator and reduce efficiency, hour by hour.

Time studies have proved that Speed-o-Matic will handle 25% or more additional yardage with less effort.

7080

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WHICH IS EASIER?

To Draw Water Out of a Faucet or Pump It By Hand?

Drawing water out of a faucet by simply turning the handle which controls the flow, may be likened to the operation of a shovel by Speed-o-Matic control. Speed-o-Matic harnesses a fraction of the power of the machine for controlling its operation, instead of requiring the manipulation of mechanical hand-levers.

To Operate a Shovel by Speed-o-Matic or Mechanical Hand-Lever Control?

Race Horse SPEED WITH DRAFT HORSE ENDURANCE

Chain Belt Opens New Plant in West Milwaukee

The Chain Belt Co., Milwaukee, Wis., has just completed the erection of a new building at its West Milwaukee works to house an enlarged machine shop and the West Milwaukee offices. All machining operations, except those in connection with chain and sprocket wheels, are being moved from the Milwaukee works to the new building so that this department, which machines all parts used in concrete mixers, pumps, Moto-Mixers and Pumpcretes, will be located close to the construction equipment plant, where all these units are assembled.

The new building, which is located on a 52-acre tract, is 152 feet x 292 feet. The West Milwaukee works now consist of a malleable foundry, the construction equipment plant, the conveyor plant, Research Department, and the principal production offices.

Booklet on Hard-Facing

A new and more complete edition of the booklet "Hard-Facing with Haynes Stellite Products," describing over 500 money-saving applications of the hard-facing process, has recently been issued by the Haynes Stellite Co., Kokomo, Ind., a unit of the Union Carbide & Carbon Corp. This new edition is the fourth printing since the booklet was issued a little more than three years ago and over 35,000 copies have already been distributed.

New sections contain information on special Haynes Stellite J-Metal cutting tools and the corrosion-resistant Hastelloy alloys. A number of examples of hard-facing automotive valves and valve seat inserts are also described in detail.

Copies of this booklet may be secured free direct from the company by mentioning this magazine.

New Dump Trucks Purchased By N.Y. Dept. of Public Works

Eighteen Model S Autocar trucks have recently been purchased by the New York State Department of Public Works. This model is a 170-inch wheelbase conventional-type dump truck, convertible for use with a snow plow as a snow fighting unit.

"CATERPILLAR" EQUIPMENT LAUGHS AT "ROAD C

An RD8 tractor with LaPlant-Choate snow-plow whamming through a 6-foot drift in Monarch Pass, Colorado.

President of Osgood Dies

Clifford A. Owens, President of the Osgood Co., of Marion, Ohio, died on July 28 after an illness of only a few days. In addition to his position as President of the Osgood Co., Mr. Owens was also President of the General Excavator Co., the Commercial Steel Casting Co., the Alloy Cast Steel Co., the Hercules Co., the Power Mfg. Co., and the Engineering Equipment Co., all of Marion.

Mr. Owens, with his father John D. Owens, who died in 1929, acquired a controlling interest in the Osgood Co. in the early days of its operation in Marion. From point of service, he was probably the oldest executive in the shovel and excavator manufacturing field. Mr. Owens is survived by a son, Robert C. Owens, who is associated with the Osgood Co. and its allied interests.

Asphalt Consumption at An All-Time High in 1936

Greater activity in low-cost road building, revival of building construction and increased use in other fields combined to make 1936 an all-time peak year in the consumption of asphalt, according to a report from the American Petroleum Institute. The total volume sold last year by petroleum refineries in the United States amounted to 4,074,745 tons, 30 per cent more than in 1935. The previous high year in asphalt sales was 1929 when refineries sold 3,888,642 tons.

Nearly three-fifths of last year's tonnage, or 2,365,926 tons, were used in road construction, an increase of 40 per cent over sales of asphalt for paving in 1935.

New Head for Westinghouse Construction Industry Section

L. F. A. Mitchell, formerly Assistant Manager of Sales for the Canadian Westinghouse Co., has been appointed Manager of the Construction Industry Section of Westinghouse Electric & Mfg. Co. Mr. Mitchell has had a wide experience in the selection and application of electrical equipment and in his new position will be responsible for making the facilities and engineering services of the company available to the entire construction field.

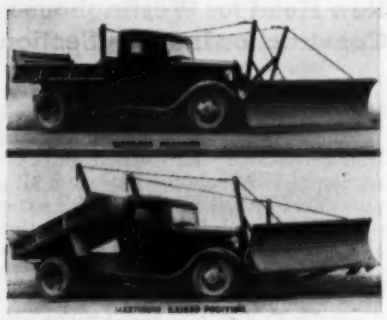
CLOSED" SIGNS!

To "Caterpillar" Auto Patrols and Diesel Tractors, a road is always open, or *soon will be!* Day and night, winter or summer, these machines lower costs. They work at 12,000 feet elevation or below sea-level; in the tropics or at 60° below zero. They are a year-'round investment. Snow-removal is just one of the things they do quickly and efficiently. Every community needs "Caterpillar" Diesel power, in every season!

A No. 11 Auto Patrol, with V-type plow and mast-type wing, clearing snow for Crescent Township near Rhinelander, Wisconsin.

CATERPILLAR TRACTOR CO.
PEORIA, ILL.
REG. U.S. PAT. OFF.

WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES, TRACK-TYPE TRACTORS AND ROAD MACHINERY



The New Warco Model HD9 Snow Plow For Mounting on Dump Trucks

New Reversible Snow Plow For Use on Dump Trucks

The new Warco Model HD9 snow plow, just announced by the W. A. Riddell Corp., Bucyrus, Ohio, is a one-way readily reversible plow for delivering snow to the right or left and designed for use on dump trucks. The standard dumping mechanism for the truck is employed in raising or lowering the snow plow. The lifting standards on the plow are connected by means of an adjustable cable and chains passing over the truck cab to standards bolted to the forward end of the truck body. It is necessary to use the truck mechanism only a little way, not enough to disturb a load, if any, in order to raise the snow plow for ample clearance. When the dump body is in load-carrying position, the snow plow is in operating position. Thus these plows can be readily attached to dump trucks already in use by state, county or township highway departments.

The push frame is an assembly of bars and angles securely electric-welded into a single rigid unit. The braces are so arranged that the entire thrust is taken on their end. The cross and angle bracing are also so arranged to take any side thrust directly on the end of the bracing. The blade is reinforced by a heavy angle running the full length of the blade. The entire push bar assembly is adjustable for height and pivotally fastened to a special truck bumper which can be used to replace the standard truck bumper.

This pivotal mounting is designed to insure the plow's operating at a level with the roadway, regardless of the level of the truck. This feature also levels the snow plow when in raised position to insure the operator a full vision at all times. The special truck bumper is furnished with the plow and can be applied by any mechanic and can be left on the truck and used in place of the standard bumper if desired during the entire season.

Complete specifications for this new Warco snow plow are contained in literature which state, county and township highway engineers may secure direct from the company by mentioning this magazine.

New Welding Electrodes

New coated electrodes especially adapted for alternating current welding have been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These Crucible-Weld electrodes, available in sizes from 3/32 to 5/16 inch in diameter, are made in two grades of black and brown. In addition a special 1/16-inch electrode is available for use with very low current values.

The black electrodes are especially suitable for down hand butt welding because of their high melting rate and ability to operate at high current values with low spatter loss. The brown electrodes are recommended for general work, horizontal, vertical and overhead welding. The special 1/16-inch electrode is useful in repair work on construction equipment.

1938 Pan American Highway Conference To Be in Chile

The Pan American Highway Conference in 1938 will be held the first two weeks in September in Santiago, Chile, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. The purpose of the conference is defined as the coordination of efforts among the member countries of the Pan American Union to advance and develop highway construction and maintenance.

The President of the Organizing Commission, who is a Chilean, will invite the governments which are members of the Union to send official representatives.

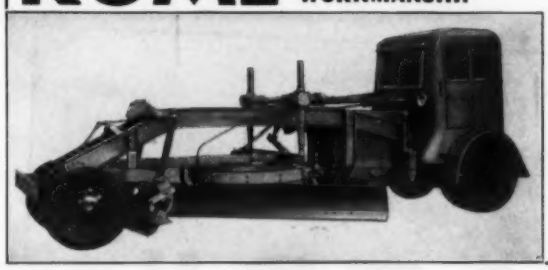
Washer Data Chart

A special washer data chart for contractors and engineers in the construction field has recently been issued by the Wrought Washer Mfg. Co., 2100 So. Bay St., Milwaukee, Wis., manufacturer of washers, expansion plugs, tools and dies for the construction industry.

This new specification table, printed on heavy index bristol and suitable for handling in the stock room or repair shop, contains complete size and dimension data of the entire range of standard wrought washers. The more frequently used washers are illustrated in exact size, to enable easy identification of a washer of unknown size merely by holding it against the illustration. Thus, the use of this chart saves time and prevents the selection of wrong washer sizes for a given job.

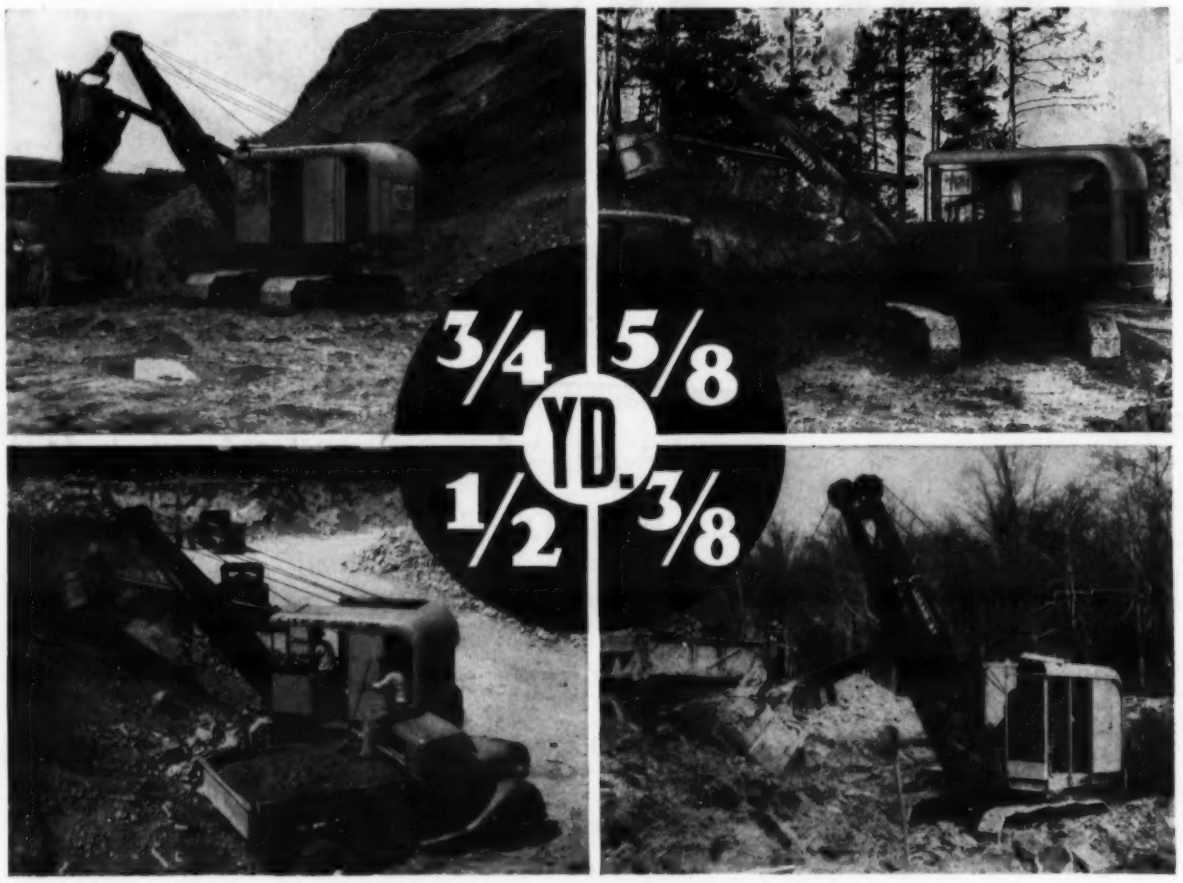
Copies of this washer data chart may be secured gratis by interested contractors, engineers, and state and county highway department equipment superintendents by writing on their official letter head direct to the Wrought Washer Mfg. Co. and mentioning CONTRACTORS AND ENGINEERS MONTHLY.

ROME DESIGN MATERIALS WORKMANSHIP



ROME DESIGN has been copied but never equaled.
ROME MATERIALS are selected to conform to definite specifications.
ROME WORKMANSHIP is first-class in every detail.
DEALERS in principal cities.
Bulletins on request

ROME GRADER AND MACHINERY CORP.
ROME, NEW YORK
Manufacturers of "High Lift" Graders, Auto Mowers, Motor Graders and Snow Plows



THEY DUG THEIR WAY TO THE TOP

Lorain 40-37-30-27's attained their present acceptance by literally digging their way into contractors' confidence. Shattering performance records right and left, these versatile machines proved conclusively that Capacities do depend on Stability and Strength, not Weight—started a new trend in shovel and crane design which others are following today. • Every feature of Lorain design has been tested by hundreds of contractors who judge machines solely on their ability to turn dirt into dollars. The best evidence of their findings is the fact that two out of every five Lorain sales are repeat orders. • So why stake your dollars on a machine which has yet to prove itself? Lorains have already proved their ability to increase production and profits.

UNIVERSAL CRANE DIVISION
THE THEW SHOVEL COMPANY
LORAIN, OHIO

LORAINS — THEW CENTER DRIVE

Concrete Lining For Sewer Tunnel In New York City

Fast Handling of Forms And Pneumatic Placing of Concrete Speed Work With Smooth Lining

(Photo on page 44)

THE lining of the new 10-foot 6-inch Bronx sewer tunnel connecting the new Bronx intercepting sewer with the Wards Island Sewage Treatment Plant brought together the ideas of an ingenious contractor, George H. Flinn Corp., New York City, and the latest in steel forms and pneumatic concrete placing equipment. After the completion of the driving of the tunnel, the invert section was poured true to line and grade and a 30-inch-gage industrial railway track set true on the invert for handling the trucks of the steel forms for the 14-inch concrete lining.

The Steel Forms

The steel forms for the tunnel lining were made in 5-foot sections held together by ½-inch bolts to give a single unit 100 feet long carried on five trucks. Each section of form comprised two ¼-inch steel sheets welded to 1¾ x 5-inch channel ribs, five to a section, and connected at the top by two hinges for each section. The connection between the sections was further reinforced with a 4½ x 5½-inch plate. The lower ends of the forms, which lapped the invert section for 6 inches on either side, were reinforced with longitudinal 6 x 6-inch H-beams, 20 feet long, as stiffeners, making five such beams on each side for the working length of the forms.

The four-wheel trucks, built of 6 x 2-inch channels with transverse I-beams, carried two screw jacks and four knee braces with turnbuckles. When setting up the forms, additional screw jacks were placed between each truck so that there were twenty-one used to hold the forms firmly against the poured invert. The individual trucks were 14 feet long and spaced 6 feet apart. The turnbuckles were set once for the proper tunnel diameter and did not have to be changed, the setting and releasing of the forms being done entirely by the 2-inch screw jacks. When the screw jacks were released, the turnbuckles attached to the knee braces on the truck carried the entire weight of the forms. The hinges at the top and the turnbuckles made possible slight changes in the shape of the tunnel where necessary.

A 24 x 26-inch manhole at the top of each section of the form was used for handling concrete pipe and for inspection. These manholes were alternated on either side of the center line. Hatchways, in pairs, at the spring line in alternate forms measured 12 x 16 inches. The contractor found that the manholes and hatchways were too small to permit speedy handling of the concrete pipe and in future forms these access openings will be made larger.

A pair of rails of 30-inch gage was carried by the form trucks so that empty cars might be run through the forms and thus shorten the ramp between the concrete placer and the forms. The contractor did not use them for this purpose but placed boards on them to form a catwalk. The contractor built two upper catwalks by welding 3 x 2¼-inch I-beams to every eighth rib on either side. On these were laid 1¾ x 12-inch plank with a 2-foot clearance between them. These catwalks permitted the laborers to go from one manhole to the next and to handle the concrete pipe and inspection more readily. These catwalks were also used by the men setting the grouting pipes. The steel forms were supplied by Koppel and Blaw-Knox from Koppel designs.

The labor organization for moving the 100-foot form, to which was attached the ramp for the concrete cars, consisted of one hoist engineer, eight timber men in the forms, two laborers and the timber foreman.

Ready-Mixed Concrete

Mixing and delivery of the concrete for the tunnel lining was handled in a novel manner. J. & I. O'Rourke, Inc., of Flushing, L. I., established a batching plant on Wards Island, bringing the aggregate and cement in by barge. The batches of maximum-size ¾-inch gravel, sand and cement were weighed out and delivered to 4-yard Jaeger truck mixers which hauled the batches across the Island, mixing en route. The concrete as delivered to the top of the chute to the tunnel had a 5½-inch slump and as placed had about a 4-inch slump.

Interior of the Bronx Sewer Tunnel, Showing Forms in Place

Inasmuch as there was no room for a

(Continued on page 32)

and 10 times more Diesel Service Hours

SINCLAIR TEN-OL

Reg. U. S. Pat. Off.

Wouldn't you like to keep your "Caterpillar" Diesel engine or tractor giving top-notch performance through many thousands of hours at lowest possible upkeep cost?

You can by using Ten-ol, the new, fused lubricant developed by Sinclair for "Caterpillar" Diesels.

Here's the proof. In laboratory tests with "Caterpillar" Diesel engines, more punishing than any service duty, and also in actual field operation, Ten-ol demonstrated that it gives ten times more service hours than the finest straight mineral oil.

In 2000-hour heavy-duty, high-output wear tests, "Caterpillar" Diesels, lubricated with Ten-ol showed less than 1/10 the cylinder liner wear shown by similar engines lubricated with the finest "straight" oil.

Order Sinclair Ten-ol, Sinclair Diesel fuel and other Sinclair products from your local Sinclair office, or write Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.

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Sinclair TEN-OL is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

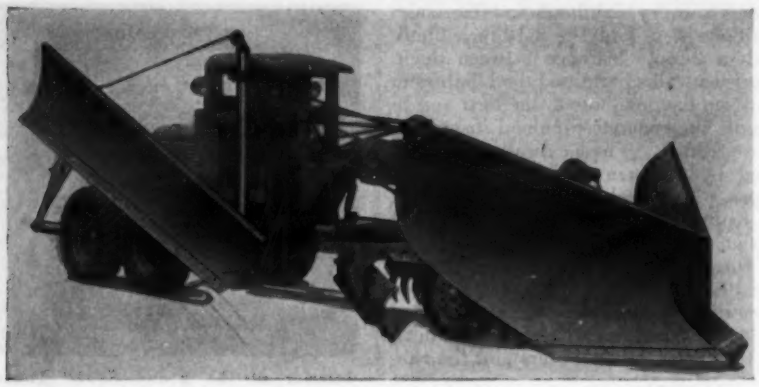
USE RIGHT BUCKET FOR THE JOB

Hayward makes all four — clam shell, drag-line, electric motor, orange peel. A Hayward recommendation is unprejudiced.

—HAYCO—

THE HAYWARD CO., 32-36 Dey St., New York

HAYWARD BUCKETS



The New Adams Snow Plow and Snow Wing Mounted on an Adams No. 51 Diesel-Powered Grader

New Snow Plow and Wing For Motor Graders

A new snow plow and snow wing for use on Adams motor graders Nos. 301, 151, 50 and 51, using engines of 39, 57, 59 and 62-hp respectively, have just been announced by the J. D. Adams Co., of Indianapolis, Ind.

The snow plow is a new streamlined model which, according to the manufacturer, has been designed to give the maximum throw of light snow at high speed and to move heavy snow with a minimum of power. The plow is 3 feet 6 inches high in front and 6 feet high at the rear. The curvature lifts the snow as much as 5 feet before throwing it out.

The new snow wing slopes the snow banks, moving the snow outward and leaving the snow banks so sloped that the moved snow will not fall back into the cleared roadway. The wing, which is 12 feet long and flares from 31 to 36½ inches in width, is independently adjustable for height at both ends. It may be set horizontally to move light snows outward as much as 10 feet or it may be angled at a height to deliver snow on top of a 10-foot bank.

Both snow plow and wing are power-controlled, utilizing the regular power outlets at the standard power control box furnished with each grader. The snow plow may be purchased and used without the wing, but the wing is designed to be used in conjunction with the plow.

New literature describing and illustrating this new snow plowing equipment may be secured by state, county and township engineers direct from the manufacturer by mentioning this magazine.

Leader in Clay Products Industry Dies Suddenly

Oliver W. Renkert, a leading figure in the clay products industry, and since 1922 President of the Metropolitan Paving Brick Co., of Canton, Ohio, died on August 6. Mr. Renkert, who was 59 years of age, has been an active figure in the paving brick and structural clay products industries. He had served as President of the National Paving Brick Association since 1931 and when the Structural Clay Products Institute was formed in 1935 became its first president. He was serving his second term as President at the time of his death.

New Blast-Hole Drill

The latest addition to the line of Bucyrus-Armstrong blast-hole drills, made by the Bucyrus-Erie Co., South Milwaukee, Wis., is the Model 27-T which has just been announced. This new drill rig weighs 18,400 pounds and has a tool capacity of 2,000 pounds.

The features of this new drill include a new built-in wrench, special bumper reel, large operator platform and other operator conveniences, rubber-insulated tool guide and sheaves, rubber shock absorber under the crown sheave, and fast penetrating drilling action. The 27-T is furnished with 33 or 40-foot derrick, crawler mounting, and a choice of gasoline, diesel, or electric power.

Several of these new drills are already in use and the manufacturer reports that the first drill on the job drilled 4,544 feet of 6-inch hole through iron ore and Taconite at a per-foot operating cost of 11 cents, including power, labor and supplies. Daily production was more than 200 feet.

ROAD MATS
TARPAULINS
WINDBREAKS
CONTRACTOR SUPPLY DEALERS in every state sell the FULTON LINE. Ask for SHUREDRY and FULTEX Tents, Tarpaulins and Windbreaks—anything made of canvas. Also Road Mats and burlap. You buy quality products at fair prices when you buy the Fulton Line.
Write our nearest plant today for catalog, samples and price list.
Fulton Bag & Cotton Mills
Manufacturers Since 1870
ATLANTA ST. LOUIS DALLAS
MINNEAPOLIS BROOKLYN NEW ORLEANS KANSAS CITY, KAN

KOEHRING

251 SHOVEL

High speed excavation with the Koehring 251 Excavator is assured by the many modern features of this popular ⅝ yard shovel. Light weight, high line and selective swing speeds, highly responsive clutches, and anti-friction bearings are important factors contributing to high production.

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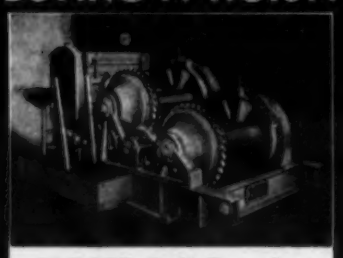
Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks
3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

BUYING A HOIST?



JAEGER Ball Bearing HOISTS up to 100 H.P. Offer . . .

- Finger-Tip Hoist Control (same as on $12,000 Shovels)
- Finest Double-Row, Self-Aligning Bearings,
- Machined, Balanced Drums
- Silent Chain Drive, Compounding Brakes, etc. 1, 2 or 3 drums (interchangeable), Gas or Electric.

Get our low prices on light 10-20 H. P. and intermediate 25 H. P. Screw Thrust Hoists. Send for Catalog H-37.

THE JAEGER MACHINE CO.
701 Dublin Ave. Columbus, Ohio

JAEGER

The New Alemite Volume Pump Lubricating the Crawler Tracks of a Euclid Wagon

A New Volume Pump for Lubricating Track Rolls

The new Alemite volume gun, recently announced by Alemite Division of Stewart-Warner Corp., Dept. F, 1850 Diversey Parkway, Chicago, Ill., is specially designed for the lubrication of crawler-type track rolls. It develops pressures of from 1,000 to 3,000 pounds, forcing the lubricant to all bearing surfaces.

The unit is of all-metal construction and the lubricant container, which holds 35 pounds of lubricant, is shaped for convenience in handling. Lubricant is delivered on both the up and down strokes of the pump. A patented feature is the automatic pressure release which relieves hose pressure and prevents lubricant leakage. The unit is easily carried by one man, its net weight with a 5-foot hose being 25½ pounds.

Complete information on this new volume gun, as well as on the Alemite Giant Button Head System, designed for extra heavy duty on track rolls of tractors and used as standard equipment on Allis-Chalmers, Caterpillar, Cletrac and International Harvester crawler tractors, and other Alemite lubricating equipment, is contained in the new manual "Alemite Controlled Lubrication" which may be secured free direct from the company by mentioning this magazine.

Highway Construction In Northeastern Brazil

By Presidential decree, the Drought Relief Commission of Brazil has just been authorized to proceed with a number of highways in the northeastern section of Brazil, considered as emergency construction, as a result of the drought in 1936 which created considerable suffering and unemployment in that section of the country, the U. S. Bureau of Foreign and Domestic Commerce reports.

The work in five of the states in northeastern Brazil will involve an expenditure of about $867,300. While no definite statement as to the type of construction was received, it is assumed that the highways to be constructed will be mainly improved dirt roads with graveling in some cases, which is the usual type of roads found in northern Brazil.

Tractor Front End Attachments

Write for Circular on types, sizes and prices

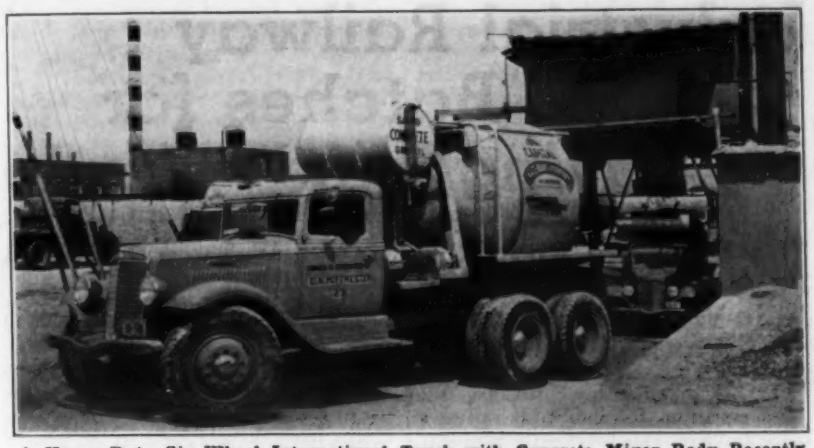
White Mfg. Co.

ELKHART INDIANA

Good Men and Equipment Build Successful Business

"Good conscientious drivers help a lot to build up success and a reputation for dependable work in the contract hauling business," says E. A. Hoffmeister, who does about 75 per cent of the batch hauling for road contractors in Maryland, according to reports. Recently, on one large 18-month job, Hoffmeister had seventy-eight pieces of equipment. He not only exercises the greatest care in picking his men but also in keeping those who have made good on the job. Five of his men have been with him since he started in business 13 years ago. In order to keep as many drivers as possible on the job during the slack season, and because he realizes the value of good equipment well maintained, Hoffmeister transfers many of his men to the garage where they repair and paint equipment.

Starting with one truck, Hoffmeister now operates a fleet of sixty trucks, forty-five of which are Internationals. A number of these units are equipped with winches, hoists, mixers, and other special equipment. Among the Internationals are twelve C-1 pick-up units which are used for rushing light material to location and in conveying workmen from place to place. Included also among the Internationals are several recently purchased Model C-55-F units equipped with concrete mixers, as shown in the accompanying illustration.



A Heavy-Duty Six-Wheel International Truck with Concrete Mixer Body Recently Purchased by E. A. Hoffmeister

HERE'S WHY 90% OF ALL SNOW PLOW BUILDERS USE BLACKHAWK HYDRAULIC EQUIPMENT!

Address of your Service Station (which repairs all Blackhawk Hydraulic Equipment) — furnished in "Service Slants". See coupon.

1 NETWORK OF SERVICE STATIONS *in the Snow Removal Belt*

Plow manufacturers choose Blackhawk Hydraulic Blade Controls because they stand the gaff better than ANY other control! IMPORTANT also to plow builders — and users — is Blackhawk's nation wide network of Service Stations — guarantee that the most vital part of the plow is kept in shape to wrestle every blizzard! Note that a Blackhawk Service Station (see map) is within 24 hours' shipping distance from you.

2 EFFICIENCY of Hydraulic Controls

New plows — and antiquated mechanical plows — are easily operated when Blackhawk Hydraulic equipped. Operator in warm cab controls the Hydraulic Blade Lifts with speed and accuracy. Greater efficiency of manpower and equipment gives taxpayers more service on smaller budgets.

3 DEPENDABILITY of Blackhawk Units

Hydraulic snow plow controls operate on the same principle as hydraulic jacks. Snow plow makers naturally choose Blackhawk—World's Largest Manufacturer of Hydraulic Jacks. Perfection in design and function of Blackhawk Controls makes the best snow plow better!

HIGHWAY DEPARTMENTS!

Here are 3 things to do before snow flies:

1 Make certain all new snow plows are Blackhawk Hydraulic equipped.

2 Take a tip from modern plow builders. Refit old plows with Blackhawk Controls.

3 Check preparedness of present Blackhawk Controls to meet winter battles. Write Blackhawk today for FREE "Service Slants" on how equipment can be ready for action at all times!

Clip Coupon -- Mail Today

BLACKHAWK MFG. CO., Dept. CM9
Milwaukee, Wisconsin

Without Obligation, send "Service Slants" for

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BLACKHAWK *Hydraulic Controls*

Industrial Railway Hauls Batches for Paving Sandy Grade

The Universal Engg. Co. Paved 7.4 Miles of U.S. 16 in Western Wisconsin As an F-A Project

TRUCK hauling has provided stiff competition for industrial railways in the last five years because the projects, only 5 or 6 miles in length, have not warranted the investment in railway equipment nor the moving of such equipment from one place to another. On its 7.408-mile paving contract for a 20-foot slab east of Sparta, Wis., the Universal Engineering Co., owner of a complete industrial railway outfit, saw that this was a railway job or else—they were going to be compelled to corduroy the whole job so that trucks could run over the sandy subgrade.

Batching Plant at West End

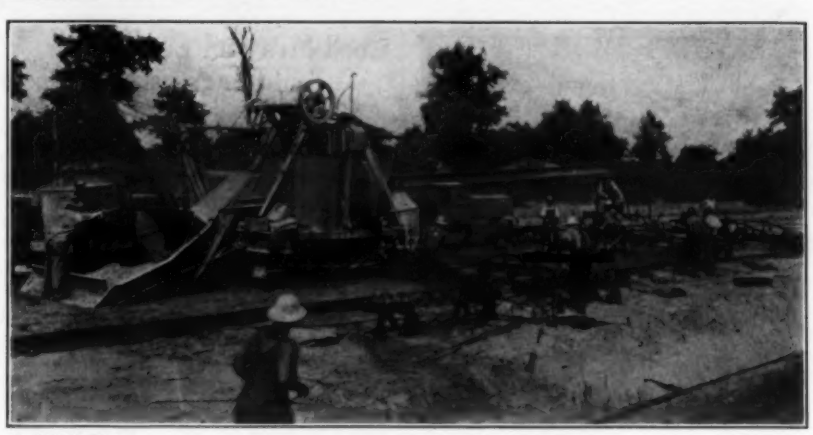
A full-gage railroad track connecting with the main line at Sparta was laid along the edge of the right-of-way of the new highway at the west end of the contract. Along this temporary spur were the two stockpiles of coarse and fine gravel and the sand stockpile with a P & H crane handling a ⅞-yard Kiesler clamshell bucket unloading direct from the gondola cars to the Heltzel portable batching bin for batching the coarse gravel and to a Blaw-Knox bin for the fine gravel and sand. The former was equipped with Kron dial scales and the latter with Fairbanks beam scales.

Since the trains of sixteen cars which were run on the grade were split up into two 8-car trains for handling at the batching plant the bins were fairly close together, thus permitting the crane to handle readily all three aggregates and for one batching man to run both sets of scales. Further, the grade of the track down into the plant was rather steep so that a booster engine would have to be used if the sixteen-car trains had been taken into the plants. The industrial railway track ran under the two batching plants and beyond a sufficient distance to permit the locomotive working in the yard to pull through to the last car. The eight cars, each with two Easton batch boxes, were then loaded with the coarse gravel, one at a time, with a trainman snubbing the cars at the proper location. The train then went ahead, during which time the batchman shifted his location, and received the fine gravel and the sand. The weights of the dry aggregates were: 1,261 pounds of coarse gravel; 1,038 pounds of fine gravel; 1,428 pounds of sand and 564 pounds of cement.

The cement platform was 84 feet long and about 14 feet wide, permitting the use of two cars of cement at a time. The ramps from the platform to the cement cars were 5 feet wide. Along the edge of the dock, over which the cement buggies were dumped into the separate containers in the batch boxes, a 2 x 4 was nailed to act as a stop for the buggy wheels. At the center of the platform and against the car side a Fairbanks platform scales was set with a bent angle iron along the scales platform to prevent the buggies crashing into the upright supporting the beams. One man wheeled and two shoveled the bulk cement into the buggies from each car. A spare cement buggy was kept for the make-up cement.

Three Milwaukee 7-ton locomotives were used for hauling and an 8-ton Plymouth for switching. A special metal

(Continued on page 22)



C. & E. M. Photo

Intense Activity at the Paver

In the twenty-five years of its business life the Le Roi Company achieved a distinguished success . . . a success built upon rendering full value in the products that bear the Le Roi name.

- **More than 500 skilled engineers and mechanics are employed in the modern, spacious Le Roi plant, comprising over 122,000 square feet of floor space.**
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- **The purchaser of any unit of Le Roi equipment—engine, air compressor, or generating plant — is assured of value through outstanding design, select materials, and advanced standards of construction.**
- **When in Milwaukee, make it a point to visit this great plant.**

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Dependable POWER
Le Roi Engines, 4 to 400 H. P., the choice of the construction industry for tried, tested and proved power on all types of equipment.

Economical AIR
Le Roi-Rix Air Compressors. Single or two stage. Portable or stationary. All mountings. Built complete in one plant.

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Le Roi direct connected Lighting and Generating Plants —1½ to 200 KW, DC or AC, any size, voltage or type—noted for silent, smooth operation and long service life.

THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD
ALL STEEL HAND HOIST
SEATTLE, U.S.A.
TRADE MARK REGISTERED
COMPACT—POWERFUL—SAFE
"For use where power is not practical or available"

Manufactured in 2, 5 and 15-Ton Sizes.
For capacity comparison, ½" cable used:

2-Ton "Lightweight"	75 ft.
5-Ton "General Utility"	250 ft.
15-Ton Triple-Geared "Special"	1200 ft.

Patent instant gear change and positive internal brake that never fails, and will lock load.

Gear Ratios	Weight	Price
2-Ton 4 & 22 to 1	60 lb.	$50
5-Ton 4 & 24 to 1	110 lb.	$75
15-Ton 4, 19 & 109 to 1	689 lb.	$200

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Fighting Snow on Oregon's Highways

(Continued from page 1)

port is made up for the press, automobile associations, chambers of commerce, etc. The radio reports from the field are addressed directly to the main station at Salem. Incidentally, any stage, truck or other commercial company interested, if equipped with short wave receiver sets, can pick up the reports as they come in from the field and learn at once where there is likelihood of blockades and re-routing of traffic.

From the department standpoint, radio gives central control for the purpose of equipment dispatching, so that all available equipment of the state can be sent to points where it is most badly needed. By these reports, the department headquarters can follow every storm and even anticipate what will be required well ahead of it.

To receive orders from central headquarters, a radio technician is among the personnel of every maintenance superintendent's office, this man being also a licensed radio operator. All the maintenance engineers have receiving sets in their cars.

Clearing Mountain Roads

In clearing the mountain highways, men must be sent ahead on snowshoes to explore the route and log the depths clear through, by reading the permanent gages that have been set up. From the data so developed, the engineers can estimate in advance the cost of opening a section of mountain road.

As far as equipment and man-power will permit, the department works ahead of a big storm as well as after it. When the storm starts, the department starts too. Chevrolet and Ford trucks operating push plows start first. As the storm increases, these are followed by heavier trucks to widen the path. Finally come the great auger-type Snogo rotary plows. Some crawler and some truck-type rotaries are also used.

Mr. Bishop states that in the tremendous drifts encountered, especially in mountain highway clearing, the rotary is the best and in some cases the only one that will do the work. Oregon now has ten Snogos with six more ordered and on the way. These machines cost $15,000 each. He also said that the only way to keep ahead on equipment is to plan in the spring and summer for next winter's work. Get the equipment in advance and as much of it as possible. There is no predicting what the weather is going to be. To wait around on the theory that "it can't happen here" can well result in a terrible jam.

Methods for Plateaus and Valleys

When the large trucks and Snogos are sent out in eastern Oregon, on the sparsely-settled high plateaus, two men are sent with each piece of equipment. Every such crew is attended by a small pick-up truck which brings up gasoline, oil and other supplies and also transports the men to and from the work when the shift is changed. This truck also enables the Snogo operators to keep in communication with the temporary base of operations set up at the nearest town or maintenance headquarters.

Snow is encountered not only in the mountains, but this year snow up to 30 inches was plowed in the valleys. The rotaries are not quite as adaptable here. The valley country is more thickly populated, and the Snogos, which throw snow high, wide and handsome to a distance of 150 feet, can not be operated in front of houses where windows might be broken or the premises buried under the avalanche. This would necessitate their being operated by skips and jumps, so the smaller equipment is usually used in such localities.

Oregon State Hwy. Dept. Photo

A Close-Up of One of the 3-Auger Rotary Snogos

That Blasted Snow

At Government Camp near Mt. Hood and on the Wapanitia Cut-off, snow depths as great as 132 inches were encountered in places. Some of this snow was so compacted as to be virtually ice and had to be blasted to permit even the rotary Snogos getting through. Rock men will probably ask how many yards per pound of explosive. The snow man replies by saying he is not interested except to get the snow loosened as expeditiously as possible, without, however, attempting to lift it out of the roadway. The rotaries take care of that. The amount of explosive is determined by experiment as the work goes on. Usually one to four sticks in a bored hole will do the work. The holes are generally bored in three rows down the roadway, perhaps 15 or 20 feet apart in the rows.

The accompanying photographs, while unusually interesting, were not selected because of any especially spectacular features but rather to show the equipment at work performing everyday tasks characteristic of the last winter. They were taken for Harold B. Say, Director of the Travel and Information Department, Oregon State Highway Commission, by Cameraman Ralph Gifford.

New Arc Welding Manual

A revised edition of the Arc Welding Manual and Operator's Training Course has recently been published by Hobart Bros. Co. This book, designed as a practical handbook on arc welding and its applicability to construction, contains considerable new material on the recent developments in methods and applications as well as in welding equipment. It is written in a non-technical manner, for the beginner as well as the more experienced operator.

Copies of this manual may be secured from Hobart Bros. Co., Box CE-77, Troy, Ohio. Price: $1.00.

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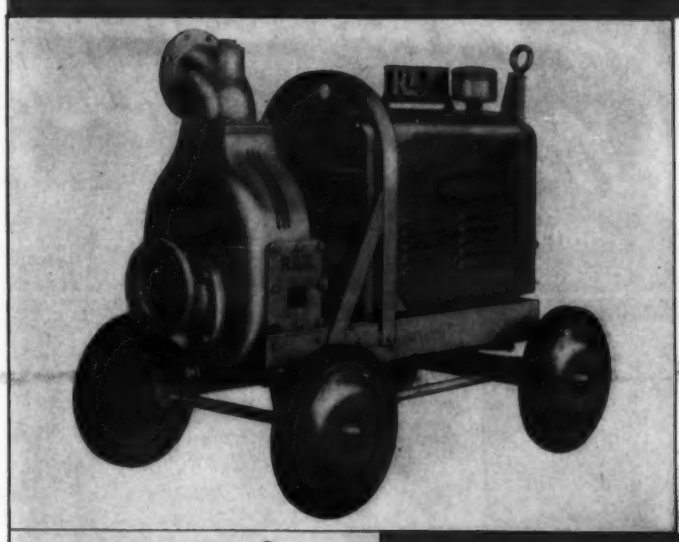
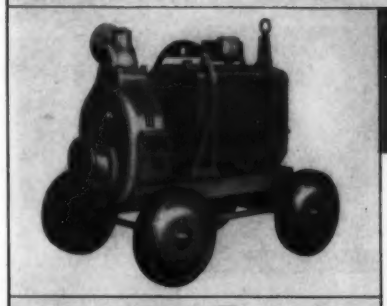
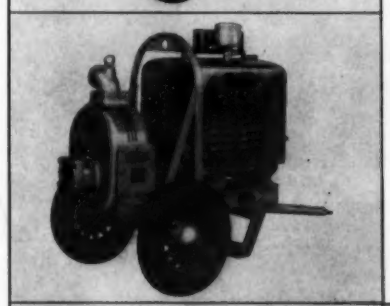
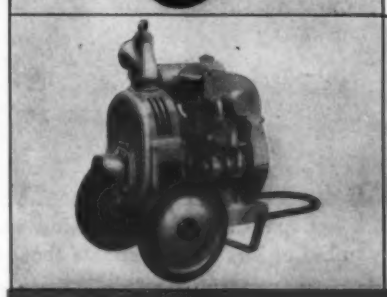


OR TONS OF IT







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Their prime control is completely automatic and recirculation stops once the pump is primed—no wasted power while pumping. The patented Rex peeler enables them to pump in the face of air leaks in the hose or loose fittings that would stop any pump with less air-handling ability.

The big recirculating water chamber keeps the water cool while priming—aids in the faster prime.

The "Z" Metal Impeller resists both corrosive water and abrasive sands—it is of the trash type to handle dirty water without clogging.

Light, modern mountings enable you to spot them close to the hole. There are sizes to meet your water-moving needs—from the little 2" 7M to the husky 8" 125M.

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REX SPEED PRIME PUMPS
CHAIN BELT COMPANY OF MILWAUKEE

Streamlining Road Shoulders

(Continued from page 2)

among the considerations entering into road design and highway engineers should give it the study its importance warrants.

Where Guard Rail Is Needed

Embankments with side slopes steeper than 1 on 4 are hazardous. On such slopes the car is likely to overturn if it assumes a position parallel to the road, and it is very difficult, in any position, to regain control of the car. This is especially true if the fill reaches a depth of about 4 feet or more.

Where the driver of a motor vehicle looks over the edge of an 8-foot shoulder, his line of sight is on an angle approximating a slope ratio of 1 on 3. The bottom of an embankment slope steeper than 1 on 3, therefore, is hidden from the view of the driver, as indicated in the diagram. The blind spots or hidden portions of slopes steeper than 1 on 3 thus present a mental driving hazard which explains and justifies the psychological need for guard rail on sections of highway having such steep embankment slopes.

Slopes flatter than 1 on 3, however, remain in full view of the highway user. A 1 on 4 or 1 on 5 slope section exposes the full length of slope to the view of the driver, thus eliminating the psychological need for guard rail. Earth slopes 1 on 4 or flatter may thus conserve highway expenditures, up to a depth of 7 feet or greater, from the standpoint both of first cost and long range maintenance and repair.

Flat Slopes Save Maintenance

Flattening the slopes in earth-graded highway sections reduces or entirely eliminates loss by erosion, simplifies initial operations of seeding and planting, decreases annual cost of necessary maintenance, and increases inherent safety and general appearance of the basic construction. The elimination of guard rail wherever possible by landscape grading of the highway cross-section also tends to reduce the drifting of snow as well as the cost of snow removal in the northern states where snow is a serious problem.

It is significant that the landscape grading of highways is a subject of growing importance. In the November 1936 annual convention address by the President of the American Association of State Highway Officials, Gibb Gilchrist, State Highway Engineer of Texas, predicted great progress in the near future in this phase of the landscape development of highways, as indicated in the following selected portions of his address:

"More and more of the states are looking to the aesthetic side of highway construction and to roadside improvement . . . As highways have been permanently located and sufficient right-of-way has been obtained, the designing engineer has tentatively become in his own way the landscape engineer, and with the technical advice of trained landscape engineers, has begun a revolution in the design and construction of cross-sections that bid fair to show more marked improvement and more visual evidence in the next few years than any single advance that has been made . . . Instead of shoulders and ditches constantly being graded and bladed and ditches filled, he now attempts to design a section with vegetative growths that present not only a pleasing appearance but is effective in preventing erosion and, in consequence, reduces his maintenance costs."

The widening of highway shoulders and the flattening and rounding of shoulder slopes is today indicative of the engineer's efforts to adapt his highway construction to fit the needs of the modern motor vehicle for safer travel. The landscape grading and erosion control methods now being applied in highway construction programs are making possible the elimination of guard rails from selected portions of highways which can be improved to the safer streamlined cross-section.

Editor's Note: A limited number of copies of the Department of Agriculture Publication No. 191, on page 23 of which is further information on grading to eliminate the need for guard rail, is still available. These may be secured from the Superintendent of Documents, Washington, D.C. Price: 10 cents.

A New First-Aid Kit

A new type of first-aid kit, known as the Brac-Kit, especially designed for such emergencies as may arise on construction jobs, has recently been developed by the Davis Emergency Equipment Co., Inc., Graybar Bldg., New York City. A special feature of this kit is that it is firmly locked, with a dust and waterproof seal, in an outer case which means that it can be permanently mounted in any convenient location, in the superintendent's office, in the cab of any piece of equipment or anywhere on the job where first-aid would be rendered. The kit, however, can be instantly removed and the contents made available for use.

The kit holds ten unit cartons containing dressings and treatments which can be selected to meet any needs. Provision is made for a wire seal to prevent unauthorized removal of supplies, thus making it obligatory, if desired, for all accidents of any type needing first-aid to be reported to the proper authority on the job.

Bids called early this month by N. W. Elsberg, Minnesota State Highway Commissioner, for paving, grading and shouldering on state highways in seven counties and trunk highway streets in five towns will add nearly $900,000 to the 1937 road construction program of the Minnesota Highway Department.

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PORTABLE CRUSHING PLANTS
No Tipping on Rough Mountainous Roads
Ideal for FARM to MARKET Road work. Adjustable crushing range from 2½" down to Agricultural Dust.
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SMITH
There's a SMITH MIXER for every size and type of mixing job. And every one is backed by Smith's 37 years leadership in the Construction Industry.

2½-S MASCOT — handy 2-wheel trailer mixer.
7-S NON-TILT — 4-wheel, side-discharge mixer.
14-S NON-TILT — 4-wheel with power loader.
84-S TILTER — 3 yd. Mixer, hydraulic tilt unit.
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112-S TILTER — 4 yd. size, World's largest mixer.
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10-S TRAILSMITH — 2-wheel, end-discharge mixer.
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27-E PAVER — automatic cycle of operations.
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56-S TILTER — 2 yd. Mixer, pneumatic tilt unit.
27-E TOWER PAVER — mixing and placing unit.
Speed of operation — thorough mix — dependable service — low maintenance cost — you get all that with SMITH MIXERS. So before you bid or buy — investigate these better mixers. Write for literature.
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SMITH MIXERS
THE BOULDER DAM MIXERS
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A Wall of Semi-Ice, a Partially-Cleared Road at Ute Park, N. M., and the Snow King Rotary Plow on a Caterpillar RD8 Which Opened up the Highway

Unusual Snow Removal Task in New Mexico

Last April the New Mexico State Highway Department was faced with the job of opening up the highway between Eagles Nest and Taos which had been completely closed since February, during which time 22 feet of snow had fallen. Mail deliveries had been made on horseback and daily thaws and nightly freezes had, with the packing of the snow by the attempts to get through, made a semi-ice condition of near glacier formation,

On April 10, the Rotary Snow Plow Co., of Minneapolis, Minn., delivered to the State Highway Department one of its Snow King rotary plows mounted on a Caterpillar RD8 tractor. It was a tough job to remove about 9 feet of semi-ice at 9,000 feet elevation, but the road was soon clear of snow. This year, the State Highway Department is planning to use this outfit to keep this road open continuously during the winter.

Snow King rotary plows, which are sold exclusively through Caterpillar dealers, are now adapted for attachment to the LaPlant-Choate hydraulic system and track mounting, making them interchangeable with LaPlant-Choate bulldozer or trailerbuilder blades. For truck mounting, these plows are designed only for four-wheel-drive trucks.

New Suction Hose To Prevent Silicosis

To combat the dreaded industrial lung disease silicosis, which has been receiving so much attention recently, the United States Rubber Products, Inc., Mechanical Goods Division, 1790 Broadway, New York City, has designed new blower and dust suction hose to meet practically every known conveying condition.

The dust hose P-5508 for abrasives is designed for either suction or light pressure such as that generated by a blower, and it is claimed will successfully withstand the abrasive action set up in the conveyance of various types of abrasive particles. The carcass of the hose is supported by a steel wire helix and is as light as is consistent with wearing qualities. It is furnished with outside corrugations to lend flexibility and is available in three thicknesses of pure gum tube, the thickness being dependent on the abrasive nature of the material being conveyed. This hose is made in sizes of 2, 3, 4, 5, 6, 8, 10 and 12 inches.

The blow hose P-5509 for fumes only is similar to the dust conveying hose in carcass construction and wire reinforcement. Since it is offered only for blowing service, a lighter construction and compounded tube are employed. Sizes range from 2 to 12 inches.

Concrete Form Device Companies Join Forces

The Richmond Screw Anchor Co., Inc., 245 Bush St., Brooklyn, N. Y., has announced its association with Superior Concrete Accessories, Inc., 4249 Diversey Ave., Chicago, Ill., in the manufacture and sale of form-tying devices and accessories for concrete construction. The Richmond Screw Anchor Co. has been established since 1911 and Superior Concrete Accessories, Inc., has served the construction field for the past 16 years.

Agencies and dealer arrangements have been established in most principal cities and literature and complete data are available direct from either of the companies.

Complete Line of
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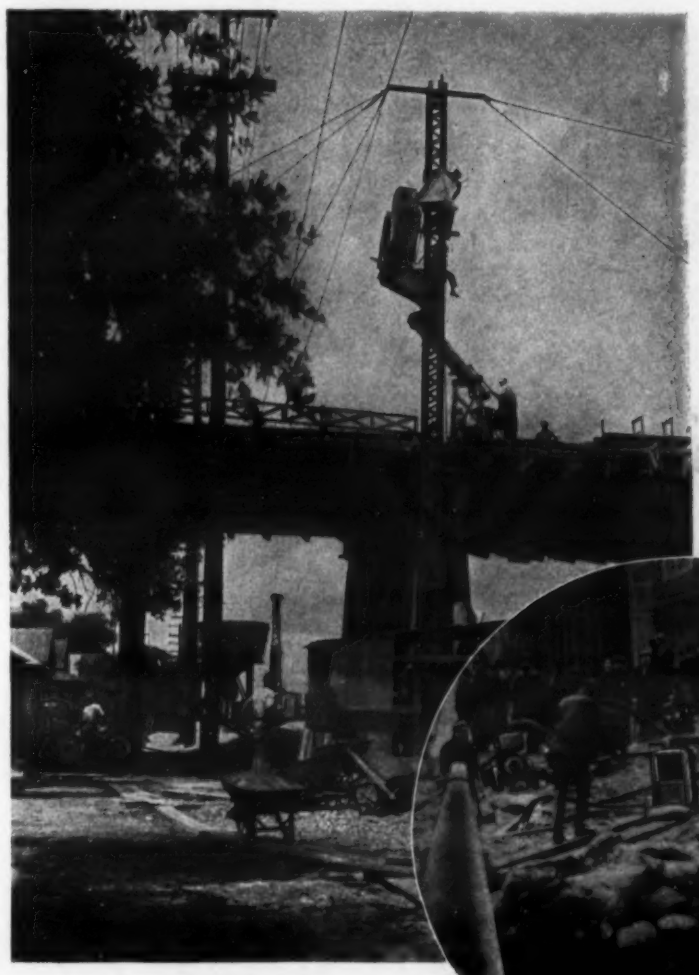

NOVO in the NEWS

With the constantly increasing construction activity, impressive installations of construction equipment hold the spot light of interest to those in the construction field.

HOISTS

An outstanding job, handling a concrete tower bucket with a NOVO HOIST on a viaduct job down in Pensacola, Florida. Efficient hoist performance attributed to the double cone frictions which take hold smoothly with a powerful grip — the easy and positive control with the Novo Screw Thrust and the Self Energizing Brakes.

DEWATERING PUMPS

One of the greatest de-watering jobs in history was the Ohio River flood. Hundreds of NOVO SELF PRIMING CENTRIFUGAL PUMPS (5 shown in this picture) were used on this de-water job to save lives and property at Cincinnati. Pumps operated night and day. Workers explained their effectiveness was due to the large, adequate power units and the long life seals which kept these pumps on the job.

CONCRETE BREAKER

Breaking out pavement, curbs and sidewalks at Fowlerville, Michigan, on U.S. 16. Part of the widening and relocating of this route. One of the largest highway jobs in Michigan this year; 45,000 sq.yds. of reinforced pavement being broken out with the ingenious NOVO PAVEMENT BREAKER owned by the Hilding Construction Co.

With two men, this breaker is shifted quickly from place to place, breaking out a curb here, a strip of pavement there and cutting a smooth trench in the concrete to be left in place. The surprisingly low cost figures on this method of breaking makes important news to contractors.

WRITE FOR LITERATURE

on these various pieces of equipment. There is also a line of pressure and diaphragm pumps, light plants and drag-line buckets.

NOVO ENGINE CO.
NOVO LANSING, MICHIGAN

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Dixon's Graphited Greases resist weather, dust-laden air, severest conditions. Insoluble in water.

DIXON'S CUP AND PRESSURE GUN GRAPHITED GREASES give maximum resistance to heat, cold, pressure, moisture. Available in all consistencies.

DIXON'S WATERPROOF GRAPHITED GREASE. Superior adhesive lubricant — preservative for outdoor machinery, wire rope, chain, etc. Adheres at highest speeds.

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JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.

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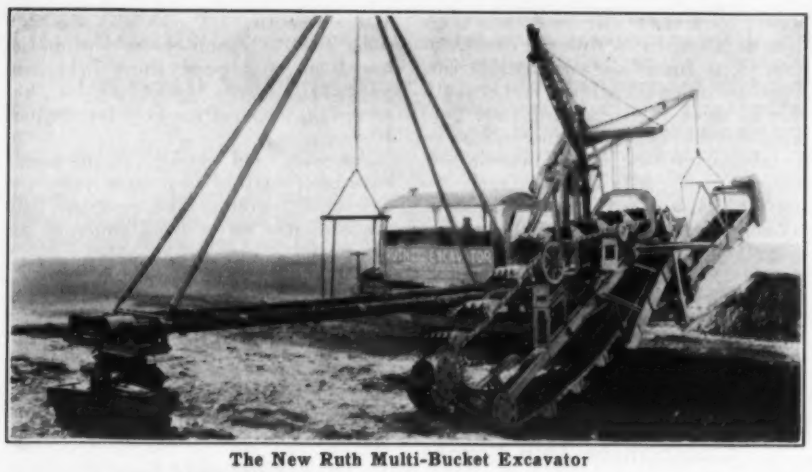

The New Ruth Multi-Bucket Excavator

Speed and Flexibility Features of Excavator

The new Ruth Multi-Bucket excavator, designed for digging and excavating as well as maintaining drainage and irrigation canals and ditches, levee building and highway construction, is a speedy unit, covering a wide range of ditch shapes, sizes and working conditions, and is flexible and easy to operate. This Model H-V excavator has eight forward speeds, two in reverse and four elevator digging speeds. Forward traction speeds while working range from 1 to 86 feet a minute and reverse speeds from 2 to 59 feet a minute. The elevator digging speeds range from 20 to 47 buckets a minute, with a digging capacity of 180 cubic yards an hour.

The forward speeds of the crawlers are synchronized with the speeds of the digging units to insure a full bucket regardless of the size cut being made. The set distance of the main elevator arm, with the adjustable cross arm, insures a definite depth and slope, to the desired grade line, whether the ditch is dry or full of water. The buckets have a patented positive-dump feature which ejects the entire contents of each load, regardless of whether the material is dry or wet or whether digging with water in the ditch, according to the manufacturer. The cutting teeth and cutting lips are of high abrasive resistant steel and are replaceable. The fully adjustable bucket elevator, which can be operated from either side of the main unit, has a vertical movement of 7 feet 5 inches, and a lateral movement of 6 feet, permitting a wide range of different sizes and types of cuts and work, as well as maintaining an even cut, regardless of the contour or irregularities of the ditch or bank. The powered extension crawler is turnable for extending or retracting, as well as for passing obstructions when in the spanning position. It can be telescopically spanned as required. Special track pads to meet any working conditions are available. When digging from one bank with both crawlers in the close-together position, the roadway required is 7 feet. There are other models to meet any size, type or condition of excavation.

The adjustable power-driven conveyor deposits the excavated material where desired, for loading into trucks or other carrying vehicles. This excavator is sturdily built for hard working conditions.

Complete information on this line of excavators may be secured direct from the Ruth Dredger Mfg. Corp., 5980 So. Boyle Ave., Los Angeles, Calif., by mentioning this magazine.

A New Diesel Engine

The new Type 8 CP diesel engine, recently announced by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, is a four-cycle direct-injection type unit designed for medium speed and continuous duty, ranging in power from 90 to 300 hp.

Features of this new engine are the shape of the combustion chamber, the location of the streamlined inlet valve and the fuel injection system. The valve passage promotes a rotary swirl during the intake stroke, and the piston on the compression stroke displaces the outer ring of air in the combustion chamber, in toward the fuel nozzle. Into this controlled air flow combined with inlet swirl, the fuel is injected from the centrally located multi-orifice nozzle. This complete mixing of fuel and air is designed to secure a clean exhaust at all loads, as well as fuel economy.

Standard accessories are externally mounted and removable as complete units for ready repair or replacement. Dust and oil-tight covers on cylinder heads and over the camshaft permit easy access for adjustments.

Complete information on this new line of diesels is contained in Bulletin No. 768, copies of which may be secured direct from the manufacturer.

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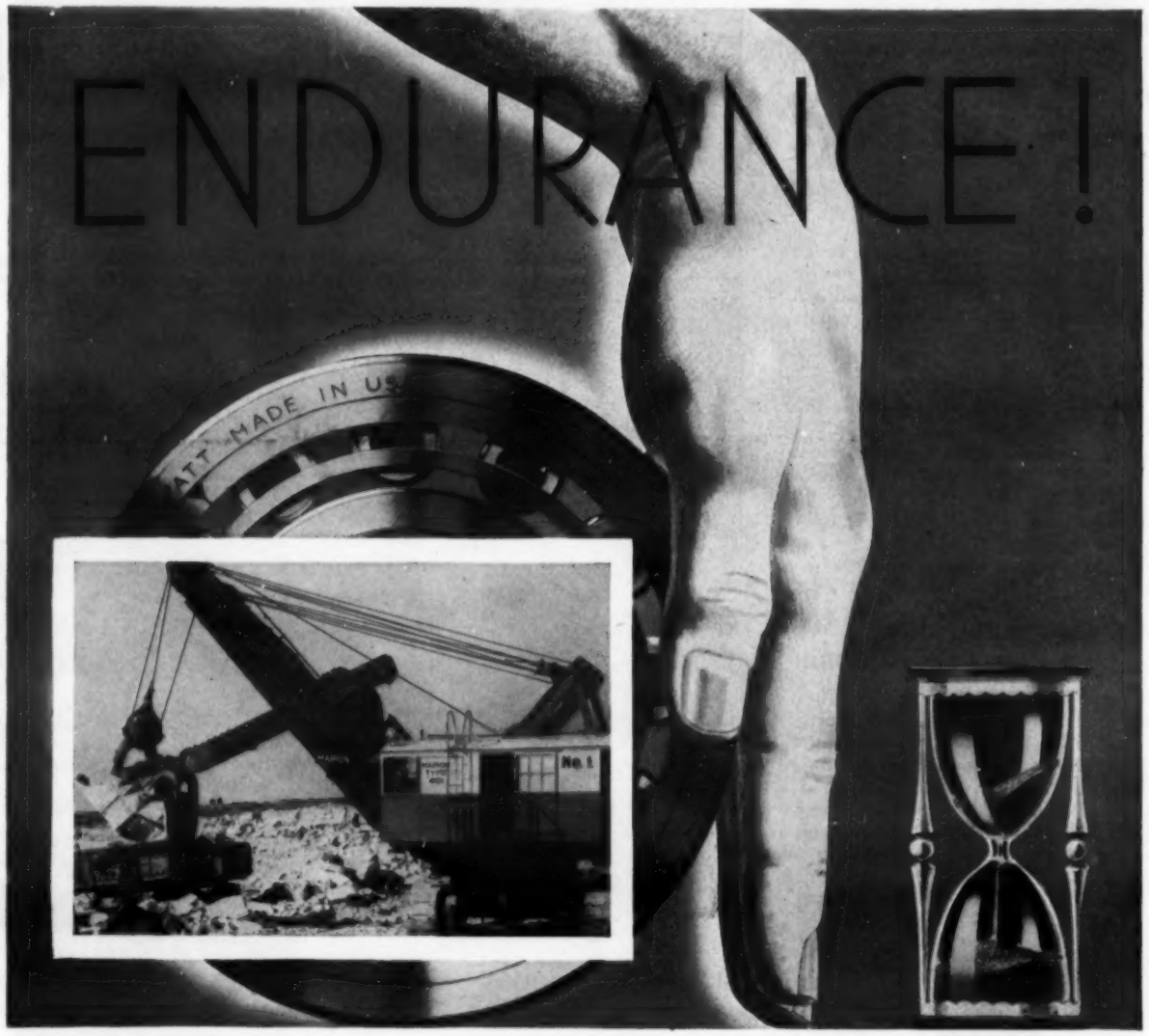
17th and Euclid CLEVELAND, OHIO



This **MARION SHOVEL** typifies the host of contractors' equipment employing Hyatt Roller Bearings for dependable year in and year out, continuous, carefree and economical operation.

HYATT

Because Hyatt Roller Bearings have greater endurance designed and built right into them, it is no wonder they are so generously employed. And, in addition to increasing the life span of the equipment they serve, they further save through the power and maintenance economies they effect. That's why machine manufacturers have such confidence in applying Hyatts and why the machine users place so much faith in Hyatt protection.

Hyatt Bearings Division, General Motors Corporation, Newark, Detroit, San Francisco. Hyatt Roller Bearing Sales Company, Chicago and Pittsburgh.

Roller Bearings

Stone Spreader Attachment Is Simple and Effective

The Gibbes stone spreader for use with trucks with bodies up to 2½-yard capacities is designed for use in building and maintaining gravel surface and bituminous surface treatment roads. This spreader, made by the Gibbes Machinery Co., Columbia, S. C., consists of a metal hopper bolted to the rear of the truck body. The flow of material is by gravity and is controlled by a manually operated gate or shutter. If it is desired to use the truck for other purposes for a time, the attachment can be removed quickly and easily by removing a few bolts. The usual spreading width of this unit is 84 inches but this can be varied to suit the requirements of the work.

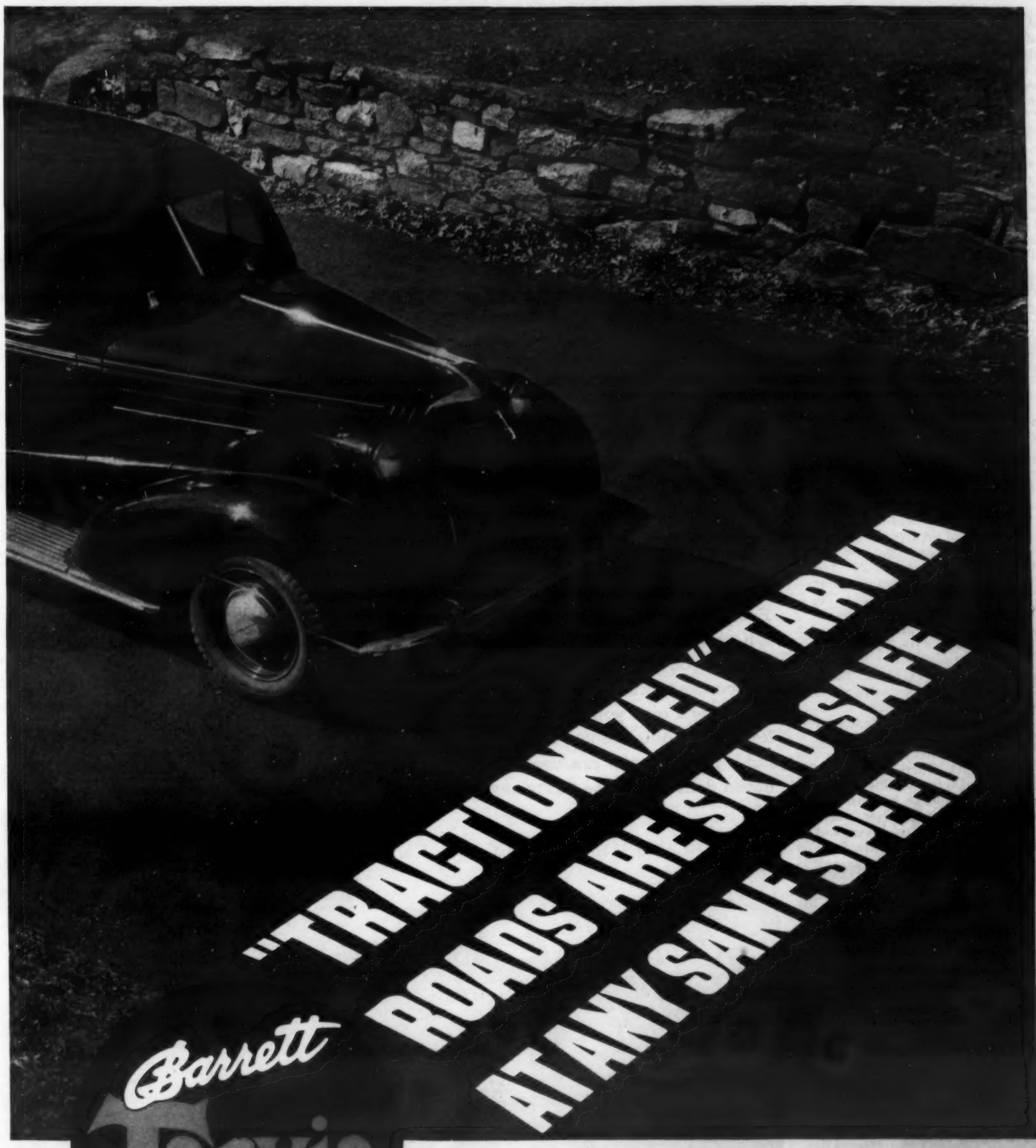
The Highest Road in Europe

In July the President of France opened the new road over the Iseran Pass near the Italian frontier. This is the highest road in Europe, reaching 9,230 feet, and surpassing the Stelvic Road in Italy and the Grossglockner Road in Austria which have heretofore held the altitude record. This new road, which is said to be the wildest and most audacious in Europe, is 16 miles long and took 9 years to build, with the loss of a number of lives, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. It is expected to become one of the chief points of interest to French tourists. From the Mediterranean it opens up an automobile route through the French Alps to Lake Geneva. It will be open only during the months of July, August and September of each year.

New Grader Catalog

A revised edition of the Adams leaning-wheel grader catalog, describing and illustrating the various types and sizes of Adams graders for light, medium and heavy-duty grading and maintenance work, and including the specifications of the various models, has recently been issued by the J. D. Adams Co., Indianapolis, Ind.

Copies may be secured by interested contractors, state and county highway engineers direct from the manufacturer by mentioning this magazine.



THE BARRETT COMPANY New York Chicago Birmingham Boston Detroit Philadelphia Buffalo Lebanon Rochester Baltimore Minneapolis Cleveland Columbus Providence Toledo Youngstown Syracuse Hartford St. Louis Milwaukee Cincinnati Bethlehem Portland, Me. Norwood, N. Y. In Canada: THE BARRETT COMPANY, Ltd. Montreal Toronto Winnipeg Vancouver

Rock Cuts in Canyon And Elevating Graders On Same Colorado Job

Diversified Excavation on 6.29-Mile Project That Also Included a Complete Gravel Plant

STANDING in front of the sheer wall of a canyon where the rock dropped by blasting had formed the new grade for a road through the canyon where the waters of the Arkansas River flowed a few months before, it was difficult to believe that "just around the corner," where Prosperity lived for so many years, was a long flat meadowland that was worked successfully with an elevating grader. Thus are the changes wrought by Nature, giving to that great mountain state of Colorado the constantly changing beauties of canyon, meadow and gorges.

Driscoll Construction Co., of Pueblo, Colo., had the contract for the grading and structures and gravel surface on the new highway just east of Cotopaxi, Colo., where for 6.29 miles they battled with the rock formations and delivered to the state a new smooth straight highway partly wrested from the stream bed of the Arkansas River. As a portion of the work lay in Federal lands the project was two-fold, FAP-113E and FLHP-2C.

The first two major cuts approaching the work from the east end were in rock and required careful handling because any unusual throwing of the rock would block the highway which ran alongside the new location. The third cut was out in the stream bed of the river.

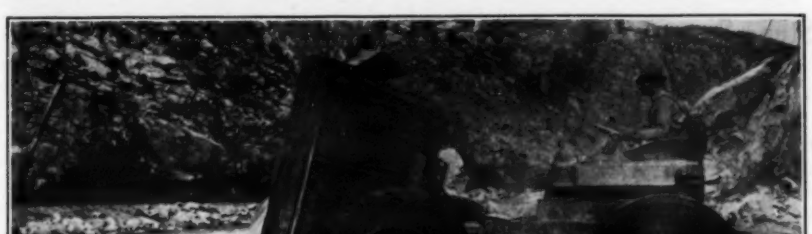
About 1½ miles from the east end was the first heavy rock cut 200 feet long, 120 feet deep and containing about 4,800 yards. It was shot off in 18 to 20-foot lifts from the top with the depths ranging from 12 to 15 feet. The face of the rock was shot for the entire length of the cut at one time, closing the road to through traffic for periods of 2 to 3 hours. The drilling in this section was done entirely with jackhammers.

The second cut, about ¼ mile west of the first, was 700 feet long, had an extreme height of 170 feet and contained 8,000 yards of rock. There was a maximum overhang of 6 feet on this cut and the only way it could be handled was to shoot it directly into the river, where it dammed the Arkansas River and started a wash on the opposite bank against the railroad right-of-way. A dragline was put in and the extra rock removed. This condition was further cleared up as soon as the water went down more as it is possible to wade across the stream in mid-summer without any difficulty. At one point in this section the railroad protected the signal post for the railroad block by placing two large telegraph poles between it and the blasting. It is about 250 feet from the face of the cliff to the wires.

On this cut there were no lifters used for the simple reason that the cliff was vertical and to have tried to put in any horizontal holes would have been to attempt a costly and useless operation. As is was, all the work done on the cliff required that the men be well protected from falling by ropes tied securely to them. After each blast, even before the shovels were put in to work, men were sent down from the top to scale the loose rocks from the face and bench.

A Marion 471 gas-electric 2-yard shovel with an Esco rock dipper was used on this cut, loading to a fleet of six 6-yard Dumptors. The rock was spread on the dump by a Cletrac 70 with an Isaacson bulldozer. Rock slopes were maintained at ¼ to 1. Rock fills were placed on a 1½ to 1 slope, and earth on 2 to 1 for fills of 3 feet and 4 to 1 for fills less than 3 feet high. The earth was always placed in 1-foot lifts and rocks in 1 to 4-foot lifts, depending on the size of rock. At least one foot of earth was used over all rock fills. At the far end of the same fill described above a Marion 1½-yard gas electric shovel was working, loading to trucks.

(Continued on page 37)



C. & E. M. Photo

Dumping Waste Rock Directly into the Arkansas River to Widen the Fill at the Base of a Cliff

POWERED TO FIT YOUR JOB . . . PRICED TO FIT YOUR PURSE

THAT'S WHY FORDS ARE THE CHOICE OF SO MANY CONTRACTORS

Some trucks give Performance. Others offer Economy. Ford V-8 Trucks give BOTH!

If your loads are heavy, if your job calls for high road speeds . . . a Ford V-8 Truck or Commercial Car with the 85-horsepower engine will give you outstanding economy for your requirements. If your loads are light, if your units are used for house-to-house delivery . . . the thrifty new 60-horsepower V-8 engine will give you the performance you need and truly amazing gasoline mileage.

Your Ford dealer will be glad to arrange an "on-the-job" test of an 85 or 60 horsepower Ford V-8 Truck or Commercial Car. With your own loads, under your own operating conditions, you can test BOTH V-8 engines . . . and select the one best fitted for your individual needs. Before you buy ANY truck or commercial car at ANY price, make this test. It may mean the difference between high and low operating costs. Call your Ford dealer today for full details.

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Write today for recommendations for your job.

Sterling MACHINERY CORPORATION

Bridge Caissons Contract Awarded to Dravo Corp.

A contract for all-welded steel caissons for the Bronx-Whitestone Bridge across the East River at New York City has been awarded to the Dravo Corp., of Pittsburgh, Pa., by the Frederick Snare Corp. of New York City, general contractor for the foundations of this bridge. The order calls for two floating caissons 38 feet square with rounded corners for the twin main pier at the Queens side of the channel span. The caissons, which are to be 21 feet in height, will be fabricated at Dravo's Pittsburgh plant and shipped by rail to the Dravo Shipyard at Wilmington, Dela., for final assembly and launching, from where they will be towed to the East River.

In addition to the floating sections, steel superstructures 89 feet 3 inches high are also required, which will make the total height of the caissons 110 feet 3 inches. The upper structures will be fabricated in Pittsburgh and shipped to the site by rail and lighter.

The main pier on the Bronx side will require two 38-foot square steel cutting edges for the twin column concrete pier. The anchorage on the Queens side requires two large cutting edges, each 100 feet x 33 feet, as well as two circular cutting edges 24 feet in diameter. The caissons and cutting edges, which will require about 1,000 tons of steel, will be of all-welded construction.

Bituminous Conference Held

The Third Annual Montana Bituminous Conference, combined this year with the National Road Oil and Asphalt Congress, was held on September 7, 8 and 9 at Glacier National Park, Montana. This combination of two conferences, devoted exclusively to discussion of methods of design, construction and maintenance of bituminous highways, was attended by about 500 highway engineers, contractors and producers in the bituminous field.

Don A. McKinnon, State Highway Engineer of Montana and General Chairman of the Conference, prepared a program in which every state as well as several provinces of Canada, Nova Scotia, and some countries in Central and South America were asked to participate.

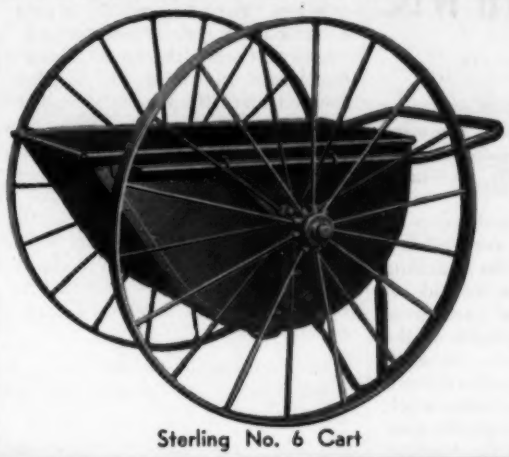
The four general sections of the conference were Research, Correlation and Development of a Bituminous Bibliography, R. N. Traxler, Barber Asphalt Co., Chairman; Developments in the Fundamentals of Bituminous Construction, A. H. Benedict, U. S. Bureau of Public Roads, Portland, Ore., Chairman; Developments in the Practical Design and Construction of Bituminous Surfaces, B. E. Gray, Chief Engineer, The Asphalt Institute, Chairman; and Maintenance of Bituminous Surfaces, H. H. Houk, Bituminous Engineer, Alabama Highway Department, Chairman. Each of the chairmen presented papers on his subject which combined and condensed material submitted by eight or ten committee members.

In the printed record of the Conference, the primary papers of the committee members, as well as the chairmen's summation, are included, resulting in a compilation of up-to-date and accurate information on bituminous practice.

County Asks State to Halt Diversion of Road Funds

A resolution asking the Illinois Legislature to submit a constitutional amendment against diversion of highway funds was adopted recently by the Sangamon County Board of Supervisors, according to a release from the American Petroleum Industries Committee. In adopting the resolution, members of the board expressed the hope that their action would be followed by other county boards in the state.

STERLING No. 6 CONCRETE CART



Sterling No. 6 Cart

6 cu. ft. capacity
42" dia. wheels
12 gauge tray
Malleable Trunnions
With Plain or Roller Bearings

A COMPLETE LINE OF STERLING WHEELBARROWS AND CONCRETE CARTS

STERLING WHEELBARROW CO., MILWAUKEE, WIS.

Now you can say "Good-Bye" to SLOW-MOTION SHOVELS

A-W 1/2 cu. yd. Badger OUTPERFORMS because it Starts—Stops—Swings faster

YOU'LL get new low production costs when you put an A-W Badger to work in the place of a slow-motion shovel.

The A-W Badger has brilliant, flashing performance—stops—starts—swings faster—for the stronger, lighter weight swinging structure avoids inertia at the start and momentum on the end of a swing. It can—*and does* outperform.

Scientific weight distribution and low center of gravity holds it steady in hard going. No tail swing—works "in tight" places. Plenty of reach, and abundance of power.

Send today for literature.

THE AUSTIN-WESTERN ROAD MACHINERY CO.
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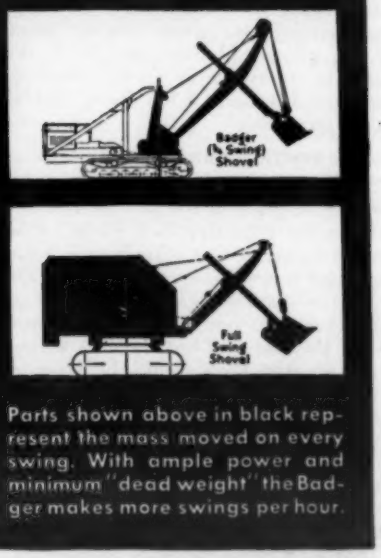

Parts shown above in black represent the mass moved on every swing. With ample power and minimum "dead weight" the Badger makes more swings per hour.

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Tell me more about the
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Air operated vibrators for all classes of concrete construction including bridge deck slabs, dams and locks.

Portable Vibrating Screed Boards for highway pavements.

Special steam operated vibrators for placing hot asphalt mixtures.

Write for circulars and engineering data

RENTALS SALES

MUNSELL CONCRETE VIBRATORS
997 West Side Ave. Jersey City, N. J.

Paving Sandy Grade In Western Wis.

(Continued from page 14)

funnel fitting into the cement container at the side of the batch boxes was used for directing the flow of the cement into the container. This greatly facilitated the loading of the cement.

The contractor's office and camp as well as storage facilities were located alongside the tracks at the batching plant. A pair of frames at the side of the industrial track in the yard were set sloping against an upright at the proper height for two men to work easily in assembling the five dowels and two transverse bars for the center steel. The assembled reinforcing was stored on the other side of the track for hauling out to the subgrade when needed.

A crew of three men maintained the track which had five sidings for the passing of the full and empty trains. At various points along the right-of-way which was in sandy soil for the entire distance the contractor drove a well with a pitcher pump attached so that the men working around the paver could have fresh cool water. As the job was started at the very height of the heat wave early in July, 1936, this was greatly appreciated by the men. The heat was so intense that for the first few days the job was stopped at noon and even later it was shut down at 2 each afternoon. Fortunately the heat abated after the first week and work went on normally with one 8-hour shift each day.

Setting Forms and Fine Grade

The matter of fine grade was easy on this job as it had been set up for a year and was quite accurate. Further the sand was so light that it was very easily moved although during the greatest heat it was so like a fluid that the men found it difficult to hold enough on the shovels to make much progress. When slightly damp it handled well.

A foreman who acted as head form setter with four men on the trenches and one man driving pins handled the forms ahead of the paver. Nine-inch Metaforms were used throughout the job. A Caterpillar Thirty pulled a Lakewood subgrader over the forms and left windrows of sandy material which were hand-shoveled out by the fine grade crew of three men. The job was located in scrub oak and pine country for the entire length. One man oiled the forms and sprinkled the grade 200 feet ahead of the paver and then went back and again sprinkled the grade just ahead of the paver because it dried out so rapidly in the torrid sun.

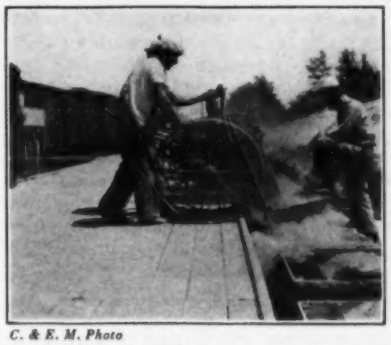
Converting Batches Into Slab

It required three men to handle speedily the dumping of the batches into the skip of the 1936 Rex 27-E paver. One man remained on the outside away from the paver and removed the covers to the cement compartments, replacing them as the boxes were put back on the Easton cars. He also snubbed the cars with a stake so that they would be stopped directly opposite the derrick boom on the paver. Another man on the outside fitted the hook into the slot on the box on that side while a man next the paver set the hook there. The man near the paver had a heavy wooden mallet with which he pounded the boxes each time to insure complete dumping of material.

The paver was set for a 64-second mixing period. It pulled a grade planer from which two men shoveled the small amount of sand that was left after the grade men had shaved the subgrade. There were two men setting the center steel behind the paver, three puddlers and a man on the Lakewood double screed. The paver pulled a strike-off by a pair of chains about 9 feet behind the grade planer. This struck off in the center for the placing of the center steel at the proper elevation. Mesh was used only over pipes, culverts, and bridge approaches.

When the Lakewood screed approached the joints both screeds were raised and when the front screed was 1 foot from the joint the finisher was stopped and all concrete shoveled from the face of the screed. Then, when it had passed over, the concrete was again shoveled against it. The finisher carried a Cleft Plane cutting wheel which was used on the second pass of the machine. The Cleft Plane machine, which was self-propelled, followed the cutting of the slot and two men installed the center joint material from rolls carried on the machine.

The handling of the cars in the trains of batch boxes to save time and prevent any delays from failure of the hauling system to have material at hand for the paver was interesting. When a full train approached the paver it waited for the empty to pull ahead and clear the next siding beyond the paver. Then it pulled alongside the paver and spotted two full cars, or four batches, and then pulled ahead onto the siding while the empty train went back and picked up the two empty cars. By the time they were out of the way the train of fourteen full cars was back at the paver and ready to deliver. The cars were emptied starting with the car closest to the locomotive which ran at the head of the train. Thus when it had unloaded its last batch it had already started in the direction of the siding ahead.



C. & E. M. Photo

The End of the Line—Dumping the Last Cement Buggy

A few lines back we left the finishing machine so now we return to the bull-float men who ran a 12-foot longitudinal

(Continued on page 34)

ON MISSISSIPPI'S $42,000,000HI

CONTRACTORS FIND THAT TRACTOR WEIGHT SAVED MEANS EXTRA PAYLOAD *Gained*

WHEN the great, planned program of highway improvement got under way in Mississippi ... Allis-Chalmers Tractors got the call! In 12 months' time, 80 contractors were awarded 232 contracts ... involving 1,605 miles of the 2,715 miles designated by the state legislature. On the majority of these jobs, Mississippi has "gone Allis-Chalmers." Contractors are selecting Controlled Ignition Oil Tractors to speed up the work. There is no excess weight in Allis-Chalmers Tractors ... you haul payload, not dead load. You get better BALANCE, higher working speeds, quicker pick-up, less maintenance. All this means "Cheaper-per-yard" performance. Ask the A-C dealer!

90% VS. 10%

On the average construction job, you do 90 per cent of your tractor work at the higher operating speeds. Allis-Chalmers Tractors are designed to deliver maximum performance at these higher speeds. Buy tractors for this 90% of your work ... not for the other 10%!

FROM FOREST TO BOULEVARD

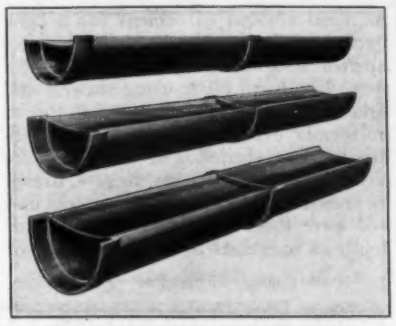
On the James Spencer & Son job near Laurel, Miss., 12½ miles of modern highway are being cut through forest and swamp. Stumps are blasted, pulled with tractors, piled and burned. A channel is cut along one side of the 200-foot right-of-way for drainage (left.) An Allis-Chalmers "WK" Tractor is shown.

ALLIS-CH
TRACTOR ISION

New C. I. Drainage Pipe

A new cast iron drainage pipe claimed to produce results even in excess of other competing drainage pipe now on the market has been announced by the Dimick-Mosher Products Co., 120 Boylston St., Boston, Mass. Designed for use in airport drainage, for golf courses, railroad freight yards, highways and other similar areas, Skip-Pipe has shown in accurately scaled models that it takes off from two and one half to three times the water removed by perforated pipe in a given time.

The manufacturer reports that in two similar models used to demonstrate the principle, one with Skip-Pipe and the other with standard perforated steel pipe, the model with the new pipe showed complete drainage with the water never rising on the surface. Under similar conditions there was a rising water table on the surface of the other model. The new drainage pipe is a sloping cradle invert pipe easily installed and readily removed, reset or replaced. It catches the water on the sloping cradle and discharges it at each joint to the carry-off section below. The manufacturer states that the need for removing sections of Skip-Pipe for repair, or because of imperfect installation, is rare as the material is cast iron known for its wearing quality, and the design of the pipe renders clogging improbable, and it would rarely, if ever, have to be cleaned.



Skip-Pipe, a New Drainage Pipe

Skip-Pipe can be made in almost any foundry, under license, because no costly equipment is necessary. It is stated that in price it is closely competitive with other underdrain pipe.

Literature describing this new pipe may be secured direct from the manufacturer by mentioning this magazine.

DIRT FLIES IN MISSISSIPPI

UPPER RIGHT: One of the Allis-Chalmers Model "L-O" Oil Tractors and 10-yard Gar Wood Scrapers on Highway 15 job of James Spencer & Son Construction Co., near Houston, Miss. The Gar Wood proves itself a "honey" for finishing.

UPPER LEFT: On their job near De Sota, Miss., Chickamauga Construction Co. use two Model "L-O" Oil Tractors and a "WK" with Baker Bulldozer. They have 13 bridges in 12 miles. Water seeps in and fills borrow pits.

CIRCLE: Model "L-O" Oil Tractors step along fast with 10-yard Gar Wood Scrapers on Spencer's job near Stewart, Miss. 12 miles of grading, drainage and bridges on U. S. 82

LOWER RIGHT: This scene on U. S. 82 is near Itta Bena, Miss. Shuptrine Construction Co. is the contractor. Unit shown is an Allis-Chalmers "L-O" and Gar Wood Scraper.

SCHALMERS *Controlled Ignition* OILTRACTORS

...TIMED RIGHT TO FIRE AT THE RIGHT TIME

ISION—MILWAUKEE, U. S. A.

Rotterdam Traffic Tunnel Started

Vehicular and Pedestrian Tubes Under Maas River in Netherlands To Be Built By Interesting Method

THE two parts of the City of Rotterdam, Netherlands, which lie on each side of the wide River Maas are connected by only one drawbridge and by one vehicle ferry. When the drawbridge is raised, traffic piles up rapidly and the congestion is terrific. The need for additional facilities has been apparent for years and there have been prolonged discussions as to whether relief could be most quickly and completely obtained by another bridge of the draw or high-level type or by a vehicular tunnel.

The high-level bridge was ruled out as computations showed that it would have to be about 200 feet above water level in order to permit all vessels to pass, and the cost of climbing to such a height with thousands of loaded vehicles each day would make it the most expensive solution for the public. A drawbridge would have to be open so much of the time to accommodate the dense maritime traffic of the busiest port in Continental Europe that its usefulness would be greatly diminished. The fact that an underwater tunnel would have to be sunk only some 50 feet below low-water level seems to have been the prevailing consideration and a tunnel was decided upon, despite the fact that no large project of this character has ever been undertaken before in the Netherlands. The success of the tunnel under the Schelde River at Antwerp probably influenced the decision.

Plans for Tunnel

The tunnel will accommodate motor vehicles, cyclists and pedestrians, affording separate thoroughfares to each class of traffic. Separate channels have been projected for motor vehicles coming from and going to the center of the city. These channels will each be 19.685 feet wide and the thoroughfares for cyclists and pedestrians, with the latter built on top of the former, will have a width of 16.404 feet each. The tunnel will have an estimated annual capacity of 8,000,000 motor vehicles.

Originally the well-known tubular shape of tunnel was chosen but now decision has been made in favor of the so-called "flat-box" form. This form is reported to have been designed by Christiani & Nielsen of The Hague. Box-shaped under-river tunnels are believed never to have been constructed up to the present time.

Methods To Be Used

The under-river part of the tunnel will be built on shore and floated to its location, and will consist of nine sections having a total length of 1,837.266 feet. Each section will be 78.74 feet wide, 27.559 feet high and 206.6925 feet long. To obtain the required depth for the tunnel in the river bed a channel at right angles to the flow of the stream will be dredged. It will be approximately 196.85 feet wide and 39.37 deep. Into this excavation the concrete tunnel sections will be sunk. After the sections are sunk, sand will be forced underneath to support them evenly.

Project Causes Discussion

Several prominent engineers in The Netherlands have expressed the opinion in daily and trade papers that Rotterdam is taking too much risk with this unprecedented shape of tunnel. They fear that the box shape now projected will be weak in design for the reason that cross

(Continued on page 35)

Road Stabilization Experiment in Wis.

(Continued from page 1)

tween the 30 and 100-mesh sieves.

Laboratory Work First

Preliminary to actual construction, a program of laboratory tests on samples of the material taken from the roadway was carried out by the Portland Cement Association, which cooperated in the work. The purpose of these tests was to determine a satisfactory cement content, and the amount of moisture necessary in the soil-cement mixture to obtain maximum density with the method of compaction used. The tests revealed that satisfactory results could not be obtained with a reasonable amount of cement and the sand alone. In the search for some remedy it was found that clay was beneficial. The tests indicated that the addition of approximately 20 per cent by weight of clay to the sand and 10 per cent by weight of cement to the sand-clay mixture was required to give satisfactory results. The optimum moisture content, or that giving maximum density of the compacted mass, for this sand-clay-cement mixture was approximately 11 per cent. The density or weight of dry material in a cubic foot of the compacted mixture was 126 pounds.

Equipment Used

With proportions determined, field operations were the next consideration. Since no equipment had been developed especially for this type of construction, it was necessary to select such units as were available and appeared likely to function satisfactorily. The equipment used on the Wisconsin project consisted of the following: four tractors, one 60, 40, 35 and 20, the lighter tractors being used with the pulverizing and rolling equipment and the heavier ones with the mixing and grading equipment; two small 16-inch tractor discs and spike-tooth harrows for pulverizing and breaking down the clay; four quack-grass diggers, ranging from 7 to 10 feet in width, for mixing operations; one large grader; one motor grader; two sheepsfoot rollers for compacting soil, one single and one double unit; four trucks for hauling cement and clay, and also for compacting; one 8-ton three-wheeled smooth roller; one 1,000-gallon oil distributor for distributing water; one pump and pipe line for supplying water to the project; and field laboratory and testing equipment.

Preparation of Sub-Base

It was decided to add clay over a width of 24 feet, and to add cement and to process over a 22-foot width to a compacted depth of 6 inches. This required approximately 780 cubic yards of clay and 2,000 barrels of cement per mile.

Since this project was built on a new roadbed consisting of loose sand which had been brought as nearly as possible to the desired shape and grade, no scarifying was necessary. Preparation of the roadbed consisted of the application of the clay. This was hauled to the project and spread by means of trucks, supplemented by hand spreading when necessary. The clay was pulverized and partially mixed with the sand by means of discs and spike-tooth harrows, after which it was mixed to the full depth by means of quack-grass diggers traveling back and forth over the length of the section being worked. The quack-grass digger is similar to a spring-tooth harrow mounted on wheels, and can be set to work at various desired depths.

These quack-grass diggers were an innovation in mixing equipment for this work. They eliminated the necessity for blading the entire mass of material back and forth over the grade and replaced the large discs and blade graders used for mixing on previous projects.

Application of Cement

Actual construction or processing began each day with the application of cement on a section of road which the Engineer estimated could be finished during the day. Cement was trucked to the project in sacks, which were spotted at regular intervals so as to provide the required amount of cement for a compacted depth of 6 inches. The sacks were opened and dumped, and the cement spread by hand labor using shovels and rakes. As soon as the cement was spread uniformly over the surface of the road, mixing was started and continued by means of the quack-grass diggers, drawn by crawler tractors, until the cement and soil were thoroughly mixed to the full depth as indicated by uniform color of the mixture. The depth of mixing was controlled by means of reference stakes placed along the shoulder. It was necessary to maintain the edges of the road during processing by shoveling material back as the diggers worked it out.

When the dry cement was thoroughly mixed into the soil, tests were made of the moisture content of the mixture, and the amount of water necessary to bring

(Continued on next page)

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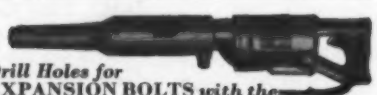

Drill Holes for EXPANSION BOLTS *with the* WODACK "Do-All" Electric Hammer
This is the electric hammer that can be changed to an electric drill. Equipped with the new Wodack tool retainer. Every contractor who uses expansion bolts needs the "Do-All" hammer for drilling in concrete, brick and stone. Soon pays for itself. Model MJA drills 1⅛" in concrete and 5/16" in metal; MDH 1⅝" in concrete, ⅝" in metal. Ask for Bulletin and prices.
WODACK ELECTRIC TOOL CORPORATION
4633 W. Huron St., Chicago, Ill.

Portland Cement-Stabilized Road

(Continued from preceding page)

it up to the optimum determined. This water was added in several "shots," each at the rate of about 2 gallons per square yard with a 1,000-gallon oil distributor. Water was brought to the work by means of a pump and pipeline, from which the distributor was filled at the side of the road. Mixing with the diggers was continued until the mixture was again of uniform color, indicating that the water had been thoroughly and uniformly dispersed throughout the mass. The mixture was then such that it could just be compressed into a ball which would withstand very light handling when squeezed firmly in the hand.

Compacting and Finishing

Having brought the sand, clay and cement into an intimate mixture and provided the proper moisture content, the mass was compacted with sheepsfoot rollers. The bearing surfaces or "feet" of the roller were 3 inches by 4 inches, and the rollers so loaded as to exert a pressure of 100 pounds per square inch when the feet were in full contact with the soil. This type of roller was used because its compaction had been correlated with the laboratory compaction. At first the "feet" settled to their full depth in the soil, but as compaction proceeded they gradually worked out until they were riding near the surface.

At this point it may be of interest to mention two factors, the moisture content and the clay, which had very noticeable effects on the success of the compacting operation. The importance of the proper moisture content may be illustrated by the comparative compaction of different spots in a single day's run having moisture contents differing from the "optimum." A moisture content of 9.3 per cent gave poor compaction, the soil being dry and crumbly; 10.5 to 11.5 per cent gave good compaction; while a moisture content of 12.3 per cent resulted in sponginess, and a tendency of the soil to peel and stick to the smooth roller. A short section of road processed with the same cement content but without the addition of clay could not be compacted with the sheepsfoot roller and the usual equipment. It was necessary to resort to a cleatless crawler tractor and lighter equipment.

The finishing procedure worked out on this project varied somewhat from that used on previous projects in other states. When the sheepsfoot roller began to ride well up in the mass, shaping of the road was started by blading material from the sides toward the center so as to obtain some crown, the compaction process being continued as this blading was done. When the roller ceased to "pack out" any further, rolling was stopped, and the road dragged with a spike-tooth harrow to remove roller marks and to loosen and smooth the surface. Compaction was then continued with a cleatless crawler tractor, followed with trucks and the distributor, starting at one side and working over the entire width of the road. The reason for finishing compaction with the tractor and trucks was that the sheepsfoot roller could not be followed directly by the smooth roller, because of its tendency to pick up the loose material.

Immediately after compaction with the tractor and trucks, the surface was bladed and "shaved" with a motor grader to bring the road to final crown and shape. This blading was started at the center, and continued toward either side. Excess material was bladed off the road and wasted. It was found more satisfactory to cut high spots completely down, with consequent waste of the excess material, than to attempt to cut them partially and fill in low spots. Any material placed and compacted on the smooth and near-finished surface was almost certain to loosen and peel off. The final shaping with the grader was followed by ironing out and smoothing irregularities in the surface with an 8-ton three-wheeled smooth roller. The finished surface was covered with damp sand to a depth of approximately 1 inch as a curing measure. The usual curing time was from 7 to 10 days.

Preparing for Next Day's Work

Upon completion of the day's construction, preparations were made for the following day's work. This included the construction of a "turn around" on the end of the completed section, the preparation of the end of the processed material for making the joint with the following day's work, and loosening up the soil in the section next to be processed. The "turn around" consisted of a board mat 4 feet to 6 feet wide at the end of the completed section with wings about 3 feet wide extending back

(Continued on page 33)

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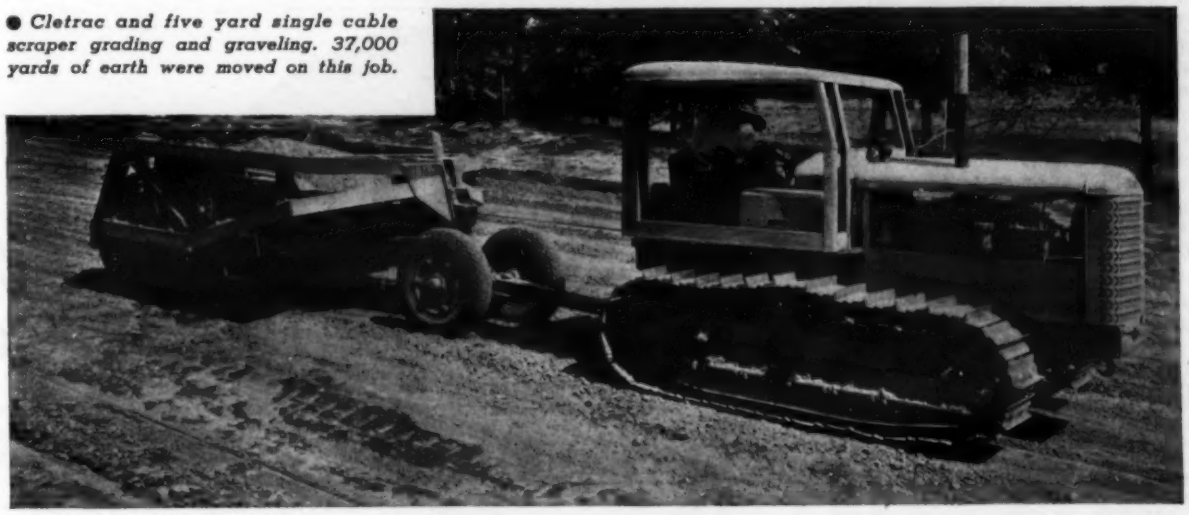

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"Built to Endure"

is more than a sales slogan of Cletrac. Write for this series of three booklets "Cletracs Are Made Better," that explain exactly why Cletracs do endure.

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Shocks and twisting strains cannot affect drive shaft, bearings, or gear alignment, because the side frame oscillates on a heavy, dead axle shaft—with no connection between drive sprocket and side frame. The dead axle shaft extends the full width of the tractor, providing unusual strength and rigidity.

Particularly important, too, is the greater accessibility of all working parts and the ease of making repairs. The engine is removed by sliding forward on the frame. The clutch can be removed without touching the engine and the change speed gears removed without touching the track. Only Cletrac gives *all* these three features of accessibility.

Highly important, too, is Cletrac's *exclusive* controlled differential steering that keeps *both* tracks always pulling—on turns as well as straightaway . . . so that Cletracs steer the same up hill or down—whether the load is pushing or the tractor pulling.

In Cletracs you have your choice, as well, of either gasoline or Diesel power—you can select the power that will suit *you* best.

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CLETRAC CRAWLER TRACTORS

The only tractors with controlled differential steering that keeps both tracks pulling at all times . . . on the turn as well as on the straightaway.

Embankment Failures, Landslides Studied

Soil Mechanics Applied In Investigations of Slips in Cuts and Fills

By K. B. WOODS, Assistant Engineer, Ohio State Highway Testing Laboratory

FAILURES in embankment after construction and the prevalent damage caused by landslides in localized areas have been apparent since the beginning of extensive highway construction. Since the attempted solution of such failures has been largely guess work in the past, the same type of failure may be expected to recur on different projects in the same locality.

Eventually, some types of failures may make themselves apparent as a result of unfortunate experience, and corrections attempted in the process of design and construction. However, such corrections do not always solve the problems involved which, in many instances, are due to the fact that little information has been available on soil types and characteristics of the materials involved. This applies particularly to the indiscriminate use of piles, retaining walls, and expensive drainage designs.

Ohio has her share of such problems, many of which are still unsolved. The eastern and southern portions of the State are quite hilly, with the geological formations comprised largely of unstable shales, clay, coal, and the more stable sandstones. Since the 1937 Ohio River flood many of these unstable conditions have become acute. As a result our Laboratory has investigated a great number of these unstable embankments and landslides in recent months and has inspected a great many more. The experience obtained in making these investigations has led to an attempt to establish a specific investigation procedure definitely based on soil characteristics established by laboratory testing. It is hoped that a description of investigating procedure, together with an interpretation of the causes of Ohio slides and the characteristics of the materials involved, may prove interesting and helpful to both engineers and contractors.

Investigation Procedure

The systematic investigation of landslides previous to any attempt at stabilization is obviously very important. This is particularly true since the development of soil mechanics to the extent that soil characteristics can be measured in terms of stability. Stability of any given soil is directly dependent on the physical characteristics, the density, and the maximum possible water content.

Records

The first item of major consideration in the solution of a slide involves obtaining and summarizing all records having a bearing on the slide. A variety of items may be involved in such records. The time of year when the slide first started should be noted as well as weather conditions such as heavy rains, severe cold, and periods of drought followed by heavy rains. The exposure of the slides to floods should not be overlooked. All past efforts at stabilizing the slide, such as the designed use of piles, drains, and retaining walls, should not be neglected. In addition such information as the presence of abandoned coal mines, building up the slide to grade by end dumping material, and records of all other slides in the immediate vicinity, should be obtained for comprehensive study.

After all records of the slide have been summarized, cross sections should be run. It is surprising sometimes to note how much information is revealed by plotting such sections superimposed on old sections, particularly those showing the original ground line.

As an illustration, experience has shown that in the case of a mass of soil moving because of a foundation failure, cross sections reveal an unmistakable bulge several feet from the original toe of the slope. The location of the bulge depends upon the height of the sliding

(Continued on page 38)

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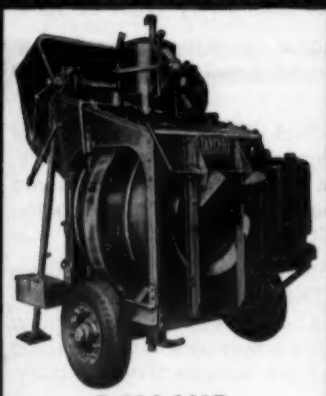

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It is new—better—always improved to meet the peak demands of modern road building.
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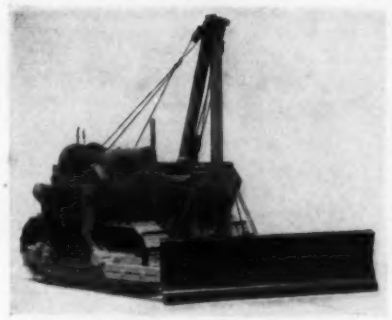

The New Trackson Anglefiller Combined with Pipe Layer

New Backfilling Unit Combined with Pipe Layer

The new Trackson Anglefiller in combination with Trackson Models PR-30 and PRD-4 portable pipe layers is designed as an economical and effective unit for pipe line construction, reconditioning or repair. The blade of the Anglefiller is easily adjustable for bulldozing dirt straight ahead or at an angle of 30 degrees to either side, cutting a path with ample overlap beyond the outside edges of the tracks. Raising or lowering of the blade is controlled by a single lever, and a safety throwout prevents damage from over-run in raising. When not in use, the blade may be secured in the raised position or the complete assembly quickly and easily removed.

The Anglefiller blade is of all-welded construction, heavily reinforced, and is equipped with a reversible cutting edge of heat-treated steel. The heavy A-frame is built of 5-inch H-beams, all welded and substantially reinforced. The pivot hinges are welded directly to the main frame support angles, so that the entire push of the blade is taken by the main anchorage of the pipe layer. The winch mechanism for raising and lowering the blade consists of a cable drum, clutch and automatic brake mounted on an extension of the pipe layer winch shaft. The Anglefiller is available only on pipe layer Models PR-30 and PRD-4 which are mounted on Caterpillar Thirty or RD4 tractors, or for field installation on these models when equipped at the factory with the necessary attaching parts.

Complete information on this combination pipe laying unit is contained in literature which may be secured direct from the Trackson Co., Milwaukee, Wis., by mentioning this magazine.

County Plans Replacement Of Obsolete Wood Bridges

Among the work planned by Fresno County, Calif., for this summer was the replacement of 140 deteriorated wooden bridge structures, requiring 3,000 cubic yards of concrete, 400,000 feet BM of lumber and 1,000 feet of culverts.

The regular work includes the maintenance of 4,000 miles of county roads, on which 100,000 barrels of road oil were used, according to a recent report from Edgar C. Smith, County Surveyor for Fresno County. Five trucks were added to the County's equipment this year.

A Trailer for Every Heavy Duty Requirement

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C. R. JAHN CO., Chicago, Ill.
Builders Bldg.

New Truck for Crews Working in the Field

A Dodge 1937 truck on which has been mounted a special body designed for large passenger capacity for construction crews working in the field, or for state and county highway department survey parties, has recently been announced by Dodge Bros. Corp., Detroit, Mich.

This unit has been constructed to accommodate at least fifteen persons, including the driver. The seat cushions are on hinges and beneath each is a large compartment which may be used for personal luggage, tools, or other necessary items. In the rear of the last seat is a spacious compartment of 45-cubic feet capacity. It opens at the rear and is large enough for the hauling of two or more tents or other bulky objects. The tarpaulin top may be mounted in only a few moments and the side curtains can be attached or detached quickly and easily. The rugged construction of this truck makes it adaptable to all types of terrain and roads.

Sales Dept. Personnel Changes at Caterpillar

Three changes in the sales department of the Caterpillar Tractor Co., Peoria, Ill., have been announced recently. Paul Weeks, who was Manager of the Washington, D. C., office until his transfer to the Peoria Office about two years ago, has returned to his former post in the Capital, relieving E. B. English who will become Manager of Federal and State Sales with headquarters at Peoria.

H. H. Howard, who has been with the company since 1926 in export and domestic sales, has been appointed Manager of the Engine Sales Division.

"WHY IT'S BETTER"

The "FLEX-PLANE" Finishing Machine "sound in principle and construction"—a single wide screed, unnecessary screeding and agitation of concrete, perfect control, screeds backwards, as well as forward, universally used.

Flexible Road Joint Machine Company
WARREN, OHIO

CLEVELAND DRILL RIG *Wins* ANOTHER BATTLE OF BULL RUN

An interesting side light on the first battle of Bull Run pertains to the large number of civilian spectators who followed the Federal army out of Washington when the advance was ordered. Senators, congressmen, other public officials, and government workers—even gaily dressed ladies—drove out to witness the first struggle of the war. Their carriages blocked roads and bridges, greatly impeding the movement of the troops. Many of the civilians were killed and wounded, and Confederate soldiers feasted for three days on the fried chicken lunches the picnickers had brought out to sustain them in their day of entertainment!

★ Down in the Old Dominion State, less than thirty miles from the Nation's Capital, there were fought during the Civil War of the sixties two of the bitterest battles of the four years' struggle. In a hundred-year-old quarry located on the historic battlefield of Bull Run, a Cleveland DR6 wagon drill recently fought another battle—against heavy odds—and won magnificently! The figures for the day—

The other drill put in 89 feet of hole, using 70 detachable bits.
The Cleveland drilled 128 feet in the same time, requiring only 48 bits.

Cleveland Drill Rigs will win for you too, on any battlefield, and against all competition. Demonstration whenever and wherever you say. The DR6 is fully described and illustrated in Bulletin 111, sent on request.

THE CLEVELAND ROCK DRILL COMPANY
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Cable Address: ROCKDRILL

LEADERS IN DRILLING EQUIPMENT

One of the New Barco Portable Gasoline Hammers

Two New Models of Gasoline Hammers

Two new portable gasoline hammers, one a heavy-duty type weighing 89 pounds and the other a lighter model weighing 70 pounds, have recently been developed by the Barco Manufacturing Co., 1801 Winnemac Ave., Chicago, Ill. Model H-6, the heavy-duty model, is recommended for pavement and rock breaking, shallow drilling, backfill tamping, asphalt cutting, sheeting driving and general demolition work. The smaller Model J-2 has been developed for continuous drilling and with it there is available a complete set-up, including a small portable compressor.

The improved features of these new models include a new timing device and rearrangement of the bottom end. The tie rod springs have been eliminated and in place of them an internal cushion spring is used. When lifting the hammer for a new location, this spring takes the shock of the blow, materially reducing the impact shock to other parts. These changes also result in increasing slightly the power of the hammer and in reducing the vibration somewhat. A new quick-acting lock for the tool is another feature, and various other minor improvements have been made.

New Series of V-Type Plows

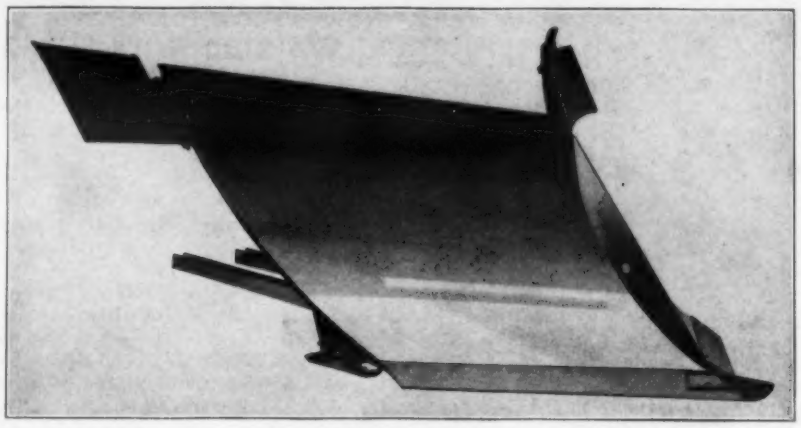
A new series of SnoFlyr V-type snow plows, designed for use with heavy-duty trucks from 2-ton capacity up to the largest trucks made, has just been announced by the Wm. Bros Boiler & Mfg. Co., Minneapolis, Minn. It is claimed that these plows may be used in wet or frozen snow and that they scour readily and penetrate any depth.

The moldboard is formed with no forward roll except for the top spring flare boards which keep loose snow from flying on the windshield. This model is wider at the top than at the bottom in order to give slope to the bank, and the stub wings form shelves in deep snow to prevent the snow from falling under the wheels of the truck. These wings may be folded back out of the way or readily removed.

The plow form is held in shape by a series of bulkheads which are electrically welded to the moldboard and to each other, forming the entire plow into one electrically welded unit. The plow is carried on three adjustable self-aligning shoes with replaceable runners, and when not plowing is hoisted by rams carried directly on the front end of the truck. Two rams are used on the larger models. The plows are attached to the trucks in such a manner that the plow thrust is taken on the front end of the truck's frame directly against the plow bulkhead. Beams running back under the axle hold the plow steady and take part of the thrust.

Side widening wings and one-way moldboard plows are made by the same company for use in combination with the V plows. Full power hydraulic operation is optional on all models.

Complete information on this line of SnoFlyr snow plows may be secured by state, county and township highway engineers direct from the manufacturer by mentioning CONTRACTORS AND ENGINEERS MONTHLY.



One of the New Bros SnoFlyr V-Type Snow Plows for Mounting on Heavy-Duty Motor Trucks

BIGGER YARDAGE!
Williams
MULTIPLE-ROPE BUCKET
Double Hinge design not only permits a longer spread of the open bucket, but more rigid and powerful construction. Write for Bulletin.
THE WELLMAN ENGINEERING CO.
7012 Central Avenue, Cleveland, Ohio
WILLIAMS
POWER-ARM, POWER-WHEEL, MULTIPLE-ROPE DRAGLINE ..... buckets

20-TON LOADS CUT DIRT-MOVING TIME ON ALL-AMERICAN CANAL

New Type Goodrich Tires Speed Work—Cut Costs

Out west they do things in a big way. Right now they're building the All-American Canal—an 80-mile waterway from the Colorado River through California's Imperial Valley. It's one of the largest dirt-moving projects on record. Three and one-half million yards of earth will be moved before the canal is completed.

Big, massive trucks of the George W. Condon Co. haul away 20 tons of dirt at a load. But only with a new kind of tire were these trucks practical. Goodrich engineers designed a special tire (it weighs almost 500 pounds) just for such service.

At the Canal and at some of the big government dams, these tires not only withstand the strain of crushing loads but carry on where the ground temperature reaches as high as 140°. They plow through loose sand, over jagged rock—all in all, the toughest jobs man ever handed tires.

These earth-mover tires are Goodrich Super-Tractions, specially-built huskies that can carry nine tons each. The tread design provides positive traction and resistance to spinning and sideslip. A riding bar in the center of the tires distributes the load and provides long, even wear.

Tires Triple Protected

Like all Goodrich Silvertowns, this tire is Triple Protected against sidewall breaks and blow-outs. This exclusive Goodrich construction actually checks 80% of all premature tire failures.

You don't have to have 20-ton loads in order to get the savings of Goodrich Super-Traction Silvertowns. These tires are available in sizes from 6:00-20 to 18:00-24—a size and type for every construction job.

Whether you need tires for trucks or air compressors, concrete mixers or tar kettles, scrapers or concrete buggies, the Goodrich dealer has a *special tire* at a money-saving price. Call him today for prices.

Goodrich Earth-Mover Tires at work on a government dam.

Goodrich Triple Protected Silvertowns

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES

Picks and Shovels

(Continued from page 1)

nothing has been done in other countries which hasn't already been done here and that the design and methods of construction devised by American engineers have been taken over and adapted to the special problems in other parts of the world.

Still more recently word has come to us of the appointment of an American engineer by the Nicaraguan Government to serve as advisor for its highway program for a four-year period. It has never been my privilege to visit Nicaragua but my experience in other Central and South American countries has been enough to induce a deep sigh of thankfulness for that American engineer, just in case my wanderings sometime lead me to Nicaragua.

There are some points on which the American superiority boasted of by those one-hundred-per-centers may be questioned. But there are two points on which this country can proudly claim undebatable superiority over every other nation on earth—our plumbing and our roads.

Welded Piping Design

Complete information on the design and layout of piping for welded connections is contained in a 200-page handbook containing over 100 figures and diagrams which was published recently by The Linde Air Products Co. The subjects covered include the fundamentals of welded joint design, standard welded pipe connections, design data on welding the various types of metals, layout, and fabrication and erection considerations.

Copies of this booklet may be secured gratis by interested contractors and engineers direct from The Linde Air Products Co., 205 E. 42nd St., New York City, by mentioning this magazine.

YES, WE CAN DIG A DITCH

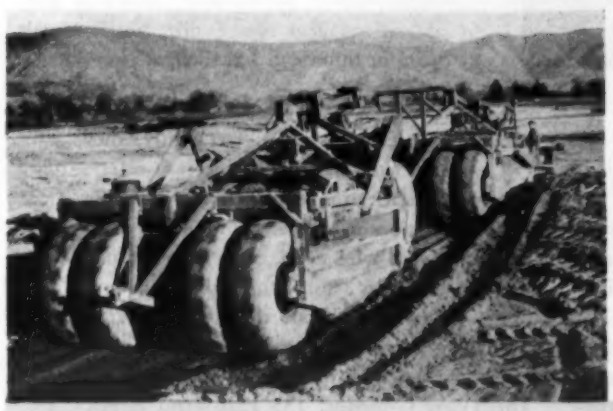
OR RIP OLD PAVEMENT, OR CUT A TRAIL, OR WORK TANDEM, OR LOAD ROCK

If you're a "doubting Thomas" take a look at these pictures. Then ask your "Caterpillar" dealer to show you what LeTourneau equipment is doing right in your own "neck of the woods." You'll soon see that, on job after job, LeTourneau equipment is moving the earth at lower costs and quicker than is possible by any other method. You will see, too, that it handles a flock of extra jobs that ordinarily require expensive extra equipment. You profit two ways when you use LeTourneau rigs—by their ability to move the earth and by their versatility. Ask your "Caterpillar" dealer to demonstrate.

(In circle)
Cutting a trail in a hillside over which heavier equipment will go to work. LeTourneau Angle-dozers are much used for such pioneering work.

▼

(right)
LeTourneau Rooter, with one standard removed, ripping up old asphalt on a Missouri realignment project.



LeTourneau 12-Yard Carryall cutting a drainage ditch on a Texas highway job.

▼

(left)
New Zealanders put a tandem hookup and LeTourneau 12-Yard Carryalls to work on an airport project, thus greatly increase yardage output per tractor and at the same time materially lower costs.

▼

(right)
LeTourneau U-18 Carryall unloading a boulder 2 cubic yards in size on a Michigan road job. The high apron lift (42 inches on the U-18) of LeTourneau Carryall Scrapers easily passes boulders and chunky material.

LETOURNEAU

R. G. LeTOURNEAU, INC., PEORIA, ILLINOIS, STOCKTON, CALIFORNIA. **Cable Address: "BOBLETORNO"**

Manufacturers of: Angledozers*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters*, Treedozers

*NAME REGISTERED U. S. PATENT OFFICE.

A Hughes-Keenan 6-Yard Hopper Trailer with an International D-35 Tractor

A New Hopper-Trailer For Hauling or Spreading

A new hopper-trailer in one complete unit for hauling and spreading gravel, stone, cinders, sand and similar materials has recently been announced by the Hughes-Keenan Co., Mansfield, Ohio. The hopper has a full 6-yard capacity and an 8-yard model is also available.

A feature of this unit is its low center of gravity. A narrow door on the forward side of the bottom of the hopper is used to discharge and spread the contents. The opening of this door is controlled by two lines leading to the cab and a lever at the rear side of the hopper. The opening and the speed of the tractor determine the depth of the spread. Due to the large leverage the hopper door can be closed against a full load when it is no longer necessary to spread. The entire outfit of trailer and tractor can be operated by one man.

The hopper is made of high-resisting steel thoroughly supported by structural members and is mounted on a large Timken extra-heavy tubular axle equipped with roller bearings, and with modern vacuum braking facilities. The unit is ruggedly constructed, thoroughly reinforced and electric welded throughout. It is equipped with dual 34 x 7 h.p. or 8.25x20 10-ply tires.

Literature describing and illustrating this hopper-trailer may be secured by interested contractors, state and county highway engineers direct from the manufacturer by mentioning this magazine.

Canada's Road Work Gains

Large scale road improvements and hard-surfacing projects were undertaken in Canada during the first half of 1937. The tourist traffic, particularly from the United States, is an important source of national income and since automobile travel is a leading factor in this trade, highway building and improvements have been initiated to encourage tourist traffic. Building roads into mining areas was also a factor in the enlarged program for road improvement.

Contracts for bridge building jumped more than 600 per cent over the first half of 1936, according to a report from the U. S. Bureau of Foreign and Domestic Commerce, as a result of the increased highway construction, replacements due to flood damage, and the letting of a contract for an international bridge across the St. Lawrence.

Roadside Beautification In County Hwy. Program

There is a distinct difference in what might be termed roadside beautification merely for the purpose of adding to the attractiveness of the road and beautification which has along with it some practical value, H. G. Sours, former County Engineer of Summit County, Ohio, and Chairman of the Committee on County Maintenance of the American Road Builders' Association, pointed out in his report to the Association last January.

While some counties are doing the former, the majority of this class of work where it is being done at all is in the nature of sodding of shoulders and slopes, together with the planting of various kinds of vines and shrubs, particularly on the high slopes in cut and fill, for the purpose of preventing erosion. A little experience with this type of work will readily prove that the cost of doing planting to prevent erosion is soon offset by the saving in maintenance.

To start out, the average county will have to buy its own nursery stock, but it is surprising how cheaply the various types may be grown and any considerable program of this kind of work would justify the county in growing its own stock.

Track-Type Equipment

New booklets containing descriptions and illustrations of Athey Forged-Trak wheels, two-way dump trailers, bottom-dump trailers and side-dump quarry trailers have recently been issued by the Athey Truss Wheel Co., 5631 W. 65th St., Chicago, Ill.

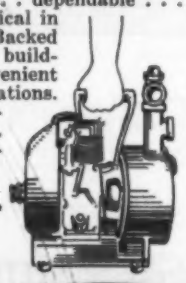
Copies of these booklets may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

YOU CAN DEPEND ON

POWER BY LAUSON

ON SMALL PORTABLE PUMPS and OTHER APPLICATIONS

The Sterling Pump . . . a complete self-priming centrifugal pump and 4 cycle gasoline motor weighing only 60 lbs. The power is furnished by the famous Lauson "Smoothflo" weighing only 26 lbs. "Smoothflo" motors are available in ½ to 5 H.P. sizes and find many uses around the "job." Sturdy . . . dependable . . . trouble-free. Economical in price and operation. Backed by 45 years of engine building experience. Convenient factory service stations. Specify Lauson motors on equipment. Send for specifications.



THE LAUSON CO.
55 Michigan St.
NEW HOLSTEIN
Wisconsin

LAUSON "Smoothflo" MOTORS

IT'S GREAT TO KNOW THEY'RE *Safe . . .*

FOR GEARS, TOO, Texaco Crater Compound reduces gear wear and quiets the noise immediately. Each gear tooth is cushioned against metal-to-metal contact by an even, tenacious film. Crater resists acid fumes, dirt, water. Won't channel or throw off. Lasts longer.

EVEN with freight cars swinging in mid-air, these workmen are confident of their safety. You can keep them safe and get far longer life from your wire rope by lubricating it *regularly* with Texaco Crater Compound.

Crater coats every wire of each strand in a tough, viscous film that checks corrosion . . . reduces internal *and* external friction. It penetrates to the very core, yet has the body *to cling*. Some wire rope lubricants fail to penetrate, and wash off in wet weather. Even though such lubricants are applied frequently, they fail to lengthen rope life or increase safety.

Trained lubrication engineers are available for consultation on the selection and application of Texaco wire rope and gear lubricants. Prompt deliveries assured through 2070 warehouse plants throughout the United States.

Order a drum of Texaco Crater. It will help carry you safely through job after job . . . The Texas Company, 135 East 42nd Street, New York City.

32 PAGES of facts about the application and use of Texaco Crater . . . where, how, and why Crater can improve the operation of your gears and wire rope . . . it's yours for the asking.

TEXACO

TEXACO *WIRE ROPE AND GEAR LUBRICANTS*

4-Mile Penetration Job in Connecticut

(Continued from page 1)

Filler sand was spotted about every 13 feet along the shoulder in piles of about ½ cubic yard each. As the base rolling continued, the sand was hand-cast longitudinally by six men who also used brooms to work it into the 2½-inch stone. One of the rollers also carried a battery of six stable brooms which were dragged after it to facilitate rattling the sand into the crushed stone. When the crushed stone had taken up all the dry sand it could, it was watered under pressure by a Ford truck on which was mounted a 600-gallon tank and a 2-inch centrifugal pump delivering the water under pressure to a spray bar with ⅜-inch holes. The stone was refilled with sand and sprayed until a sand grout was carried in front of the roller, then a second 3-inch base course, also 21 feet wide, was laid in exactly the same manner and sand-filled.

Penetration Top

Using the same method of spreading the stone a top course of 2-inch stone was spread 20 feet wide and rolled to 2½-inch thickness until final compaction. The Connecticut specifications call for rolling until the hard rock is about to fracture. On the top course, in addition to the spreader-box men and the three men with stone forks, there was one man handling the final spotting, and great credit is due to him for the final smoothness of top course, which showed a minimum of variation under a longitudinal straight-edge.

The 85 to 100-penetration Texaco asphalt was furnished by Ford Brothers and hauled from a railroad siding at Cornwall Station and applied by a 1,000-gallon Etnyre pressure distributor mounted on a Mack heavy-duty truck. The average load hauled was about 850 gallons and the application was made at the rate of 1.85 gallons per square yard at a temperature ranging from 310 to 335 degrees F.

Immediately following the application of the asphalt a crew of six men, three to a side, hand-cast ¾-inch chips longitudinally at the rate of about 6 tons per 100 feet of 20-foot road. These chips were immediately rolled into the penetrated rock with one of the 12-ton rollers equipped with wet fibre mats on the rolls. Rolling was continued until there was no weaving of the rock in front of the rolls. The six-man labor crew hand-broomed the stone to fill all of the top voids so as to secure a very tight surface.

After the job had been running several weeks, the contractor installed a Detroit-Harvester power broom mounted on the front of one of his motor trucks. This broom was used to remove all excess filler stone on the penetration top prior to the application of the seal, as well as to clean the two base courses of excess sand before the next succeeding course of stone was spread. No matter how faithful and energetic hand sweepers may be, it is practically impossible for them to equal the thoroughness of a rotary broom properly adjusted as to angle of brooming, speed of rotation and pressure on the road.

A seal coat of ½-gallon of asphalt per square yard was applied on the clean penetration surface and then ½-inch stone chips were hand-cast longitudinally at the rate of 4 tons per 100 feet of 20-foot surface, rolled and broomed. As the excess chips were pushed off the road by traffic during the period that the contractor was working on the road, they were broomed back to insure as complete a coverage of the surface with chips as possible to furnish a non-skid surface.

The first flush of asphalt from the pressure distributor was caught in two sections of old corrugated culvert pipe about 15 inches wide and each about 12 feet long, equipped with heavy handles made of iron rods. As soon as the flusher had pulled away, two men pulled the troughs out to the side and emptied the asphalt into the ditch so that it did not accumulate too rapidly and make the troughs too heavy.

Quantities

Earth excavation	7,314	cubic yards
Rock excavation	25	cubic yards
Unclassified excavation	470	cubic yards
Trench excavation	1,150	cubic yards
Gravel borrow	3,218	cubic yards
Formation of subgrade	55,795	square yards
Slopes and shoulders	20,744	linear feet
Grading and filling subbase	5,694	cubic yards
Broken stone base	21,262	tons
Broken stone surface course	9,119	tons
Surface course	9,119	tons
Asphalt	145,727	gallons
18-inch reinforced concrete pipe	72	feet
30-inch reinforced concrete pipe	40	feet
Slope paving	135	square yards
Tile outlet	210	linear feet
Relaid tile outlet	200	linear feet
Bar mat reinforcing*	500	square yards
¼-inch premoulded expansion joints	350	square feet
Portland cement	248	barrels
Class B (1:3:5) concrete	202	cubic yards

*This and following items apply to an old bridge which was converted into a culvert carrying 37 feet of fill. A 12-inch reinforced concrete floor was built between the 18-foot bridge abutments. The flooring was 160 feet long and 24 feet wide.

C. & E. M. Photo

The 1,000-Gallon Etnyre Distributor Takes Off, Applying Asphalt to the Full Width of the Roadway

Personnel

This 4.11-mile penetration macadam contract was started April 1, 1937, by L. Suzio Construction Co., Meriden, Conn., with Frank L. Suzio in charge, and completed on August 15, 1937. For the Connecticut State Highway Department, H. D. Patterson, Junior Highway Engineer, was in charge in the field under C. H. Trowbridge, Resident Engineer.

Don't forget the American Road Builders' Association Convention and Road Show to be held in Cleveland on January 17-21, 1938.

W. H. FINCH, *Clifton, Arizona.*
P&H machines crowd and swing faster and they have anything I've ever seen beat on travel.

"WHO'S TALKING ABOUT LOWER COSTS?"

● Without mincing words, all welded construction with alloy steels has made each one of the new P&H Pacemakers the huskiest, fastest and leading excavator in its class . . . barring none. Every buyer of excavators will find it to his advantage to investigate P&H construction and what it means in terms of bigger yardages, and lower operating and maintenance costs. For information on the size you are considering, address the Harnischfeger Corp., 4419 West National Avenue, Milwaukee, Wis.

HARNISCHFEGER CORPORATION

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

Concrete Lining For Sewer Tunnel

(Continued from page 11)

run-around at the bottom of the Bronx riser, Flinn drilled a 12-inch hole 150 feet north of the shaft over the center line and down to the roof of the tunnel 150 feet below the surface. This hole was lined with an 8-inch pipe grouted in place. The concrete was poured from the truck mixer into a hopper at the top of the 8-inch pipe and delivered through the pipe to another hopper with a bottom-dump bucket at the lower end. The laborer at the top hopper operated a pneumatically controlled plug in the top on signal from the man operating the bottom hopper.

The train of six 1-yard Koppel concrete cars was loaded with ¾ yard of concrete per car and pushed forward by a Milwaukee electric locomotive to the foot of the 60-foot ramp leading up to the Pressweld pneumatic concrete placer. The cars were hauled up the ramp by a Clyde single-drum air hoist with a ⅝-inch cable.

Air at 105 pounds pressure was used in the concrete placer which delivered the ¾-yard batches through 12 feet of flexible metal rubber-covered pipe to the 8-inch steel concrete delivery pipe laid over the center line of the forms. The maximum length of delivery was about 140 feet from the machine to a T placed on the end of the 8-inch steel pipe so that concrete would be placed uniformly on both sides of the center line. When placing concrete at the top the T was removed and the concrete delivered from the open end of the pipe. During the placing of the concrete it was tamped by hand and the forms hammered inside. This pneumatic concrete placer lined 5,400 feet of tunnel in 54 consecutive working days, placing as much as 200 cubic yards of concrete in the one shift.

The labor organization for producing, handling and placing the concrete consisted of the truck driver, a batch man or checker at the batching plant and two laborers, one to spot the truck and the other to dump the batch into the funnel at the top of the delivery pipe, and a laborer at the top hopper. In the tunnel, one man handled the loading of the cars from the bottom hopper, and in addition there were one motorman, a hoist engineer for the cars, the foreman, five laborers unloading the cars, one of whom hammered the form inside as the concrete rose. There was an assistant foreman at the form who was the boss of the tampers. Four laborers did the tamping, two on top and two in the side walls. A carpenter placed the wooden bulkhead at the end of the form, using 2-inch timber with 4x4's and 4x6's for framing. There were two pipe men who placed the grout pipes and did general repair work and welding, and one concrete blower man.

The concrete and form crews were entirely separate. The concrete crew worked the 8 A.M. to 4 P.M. shift and the form crew worked the 12 midnight to 8 A.M. shift.

Grouting was done with a Ransome pneumatic grouter at 105 and 300 pounds pressure. For the high-pressure grouting the same equipment was used, supplemented by a booster which was governed so that the pressure would not exceed 300 pounds. Neat cement was used for high-pressure grouting and 1:1 grout for the low-pressure work.

Personnel

The Bronx tunnel is a part of Contract No. 3 of the Wards Island Sewage Treatment Project of the Department of Sanitation, New York City, William F. Carey, Commissioner. The engineering work was in charge of Walter D. Binger, Deputy Commissioner in Charge of Engineering; Richard H. Gould, Chief Engineer, Bureau of Sewage Disposal and Intercepting Sewers; Herbert M. Hale, Construction Engineer, Wards Island Project; W. R. Barry, Deputy Construction Engineer and Thomas McKeon, Engineering Inspector at the Wards Island shafts and tunnel. A. Hjort is Chief Engineer, Frank Lee, General Superintendent, and Conrad Hageman, Construction Superintendent, for the George H. Flinn Corp., of New York City, contractor for both the Manhattan and Bronx shafts and tunnels.

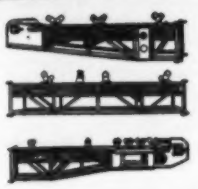
New Lincoln Sales Office

The Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc welding equipment, has announced the opening of an office at 1241 32nd St., Sacramento, Calif., to provide a complete arc welding sales and engineering service in that territory. William F. Fischer, who has had over five years' extensive experience in the welding field, is the representative in charge of this Sacramento office.

Record Diesel Order

The largest single shipment of high-speed heavy-duty diesel engines for commercial vehicles in the history of the industry has just been delivered to the General Motors Corp., by the Hercules Motors Corp., of Canton, Ohio. These 100 Hercules DJXB diesels will be installed in Chevrolet truck chassis for foreign markets. The power units are of the Hercules standard six-cylinder type, developing 77 horsepower at 2,600 revolutions per minute.

NEW WAYS TO CUT MATERIALS HANDLING COSTS



The flexibility and adaptability of the Porta "Model 347" sectional conveyor offers wide opportunities for cutting costs and increasing profit in the handling of concrete and aggregates.

Made up of independent sections.

Can be used on wheel truck, caster mounting or on supports as permanent or semi-permanent conveyor.

Easily disassembled, easily transported, easily reassembled. Our catalog describes our complete line of portable, sectional, and permanent conveyors designed to suit every contractor's requirement.

PORTABLE MACHINERY CO., York, Pa.; Clifton, N. J.; Chicago, Ill.

88 BRIDGES
INCLUDED IN FLOOD TOLL

THIS new concrete bridge replaces one of 88 bridges destroyed or damaged in Division No. 9 of the New Hampshire State Highway Department by last year's disastrous floods.

Using calcium chloride admixture in the concrete, the highway department replaced or repaired these 88 bridges during the period from October, 1936 to spring of this year—right through the winter. The high early strength accomplished by calcium chloride admixture made this winter bridge construction possible, as it makes *all* cold weather concreting possible.

High early strength, decreasing the time necessary for protecting the concrete, is not the only advantage gained by the use of calcium chloride. Exhaustive tests by the National Bureau of Standards reveal, to quote from the report itself:

> *"Calcium Chloride not only greatly increases the early strength, but also appreciably increases the three year strength of the concrete. All concretes with Calcium Chloride have greater strength than plain concrete, at all ages."*

Any concrete construction where speed, strength and finish are factors can be done faster, with better results and at lower cost, when calcium chloride is added to the concrete. Its use is doubly important during the coming cold weather months, if schedules are to be maintained without sacrifice of strength, quality and finish.

CALCIUM CHLORIDE
MAKES COLD WEATHER CONCRETING EASY

Latest information on methods and specifications of calcium chloride admixture in concrete is available from any Association member. Write for it today and find out how cold weather concrete can be made safe and economical.

CALCIUM CHLORIDE ASSOCIATION

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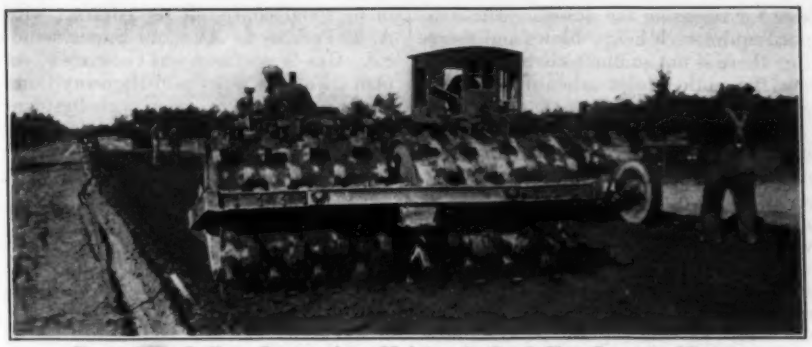
The Dow Chemical Company - - - - - Midland, Michigan
Michigan Alkali Company - - - - 60 E. 42nd St., New York City
Solvay Sales Corporation - - - - - 40 Rector St., New York City

CALCIUM CHLORIDE
YEAR 'ROUND CONCRETE CONSTRUCTION



Sheepsfoot Roller Compacting Moistened Sand-Clay-Cement Mixture

Road Stabilization Experiment in Wis.

(Continued from page 25)

and covering the edges of the road. This mat and the entire road was then covered with sand or soil to a depth of 6 to 8 inches for a distance of approximately 50 feet. This protected the surface from the wheels of the equipment as it was turned around during the following day's work. There was a certain amount of "dragging out" of the cement mixture at the end of the section processed and preparation for the joint consisted of cutting this back to sound, dense material and beveling off the end. The joint was of the feathered edge or beveled type. This joint was not satisfactory, because the feathered edge of the "overlap" would chip and spall off. Several vertical butt joints were made. Certain difficulties in mixing and compacting the material right up to the vertical end of the previous day's work made this joint difficult to construct.

The average length of section processed in a day was 513 feet, with as much as 660 feet on several of the last days. The work was begun late in the season, and since it was a new type of work there naturally was a considerable amount of experimentation with equipment and procedure. Of those available and tried, the ones described gave best results; they are not, however, to be taken as entirely satisfactory.

Protective Surfacing

There was some shrinkage after final compaction of the road, as evidenced by the formation of shrinkage cracks noticed at intervals of approximately 25 feet upon the removal of the sand covering. Also, there was some scaling and spalling of the surface attributed to improper finishing and attempting to patch or fill low spots. The clay could not be completely pulverized with the equipment available, and small clay balls were apparent in the surface of the road. It was, therefore, deemed advisable in this case to protect the surface from abrasion with a light wearing surface, or armor coat. This consisted of an application of 1/3-gallon of a heavy tar, T.H.-4, and 20 pounds of stone chips per square yard.

Results

In order to check the effectiveness of the field operations, certain tests of the compacted and hardened material in the road were made, and the results compared with laboratory test results. The average of 48 field density tests showed a weight per cubic foot of 120 pounds. Later a number of cores were taken from the road, and density tests made in the laboratory on these cores showed a weight per cubic foot of 123 pounds. These results compare favorably with the density of 126 pounds per cubic foot obtained in the laboratory tests. Field density tests on the section processed without the addition of clay showed a weight per cubic foot of 116.4 pounds. Measurements of the thickness of the compacted material taken when field density tests were made showed an average of 6.3 inches for the middle of the road and 5.7 inches 2 to 4 feet from the edges.

The section processed last fall has come through the winter in good shape, and it is planned to complete the remaining 1.5 miles this summer. This type of construction is not intended for use on primary roads, and, since the project is located on a heavily traveled state highway, it is planned to use the cement-hardened soil road as a base and provide it with a bituminous wearing surface.

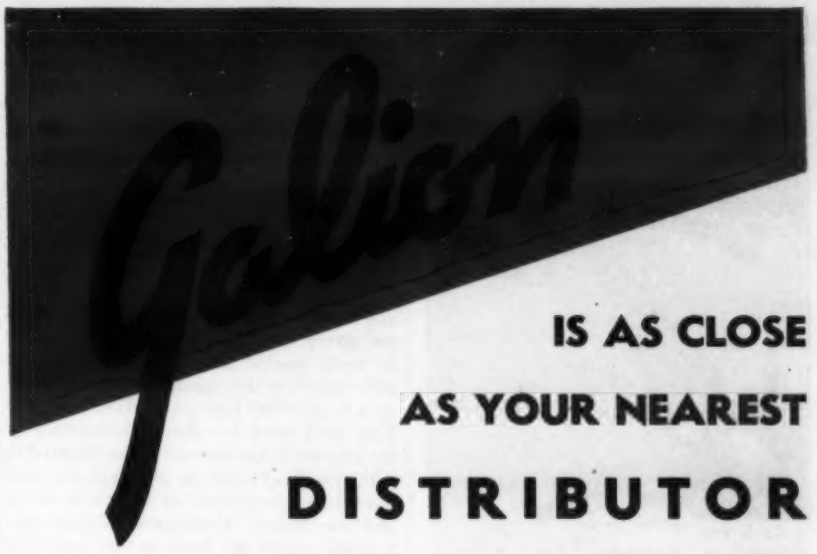
The work on this project was done by Adams County labor, at the expense and under the supervision of the State Highway Commission, working in cooperation with the Portland Cement Association, who also made the preliminary tests and designed the proportions.

Highway Committee Adopts Road Plan for Arkansas

The Arkansas State Planning Board's Highway Committee recently adopted and submitted to the State Highway Commission a tentative plan for a 5,300-mile primary highway system for Arkansas. The purpose of the plan is to set up a reasonable ultimate system of primary roads of interstate importance.

There are approximately 9,000 miles in the present highway system in Arkansas, of which 2,500 are paved. It is estimated that the completion of the proposed primary system alone will cost about $122,000,000. Because of the expense of the proposed improvement, Planning Board members felt that some systematic program is necessary so that priority may be assigned to roads of vital importance.

Oil Distributor Applying a "Shot" of Water



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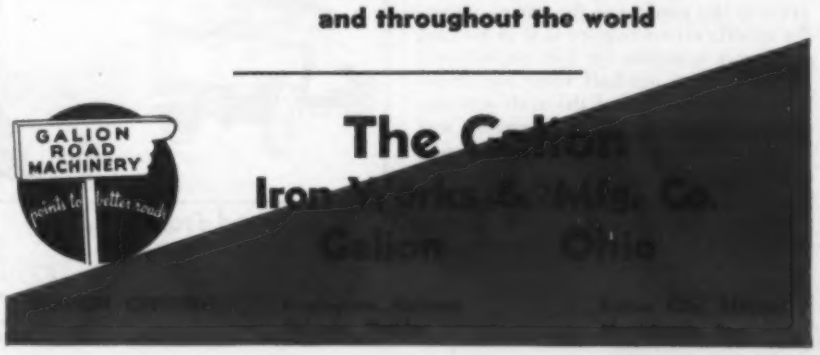

The Galion Iron Works & Mfg. Co.
Galion Ohio

C. & E. M. Photo

Setting an Expansion Joint with a Special Machine

Paving Sandy Grade In Western Wis.

(Continued from page 22)

float from a rolling twin bridge. They also used a 10-foot wood drag straightedge and the long-handled 4-foot float for patching as well as the 8-inch canvas belt. Three men edged the expansion joints and sides. As soon as that was completed two men who placed the burlap behind came forward and did the broom finishing with fiber brooms. The burlap was wet before placing and sprinkled immediately after and for the remainder of the time it remained on the slab. The specifications require that it be removed before 10 the following morning at which time the pavement was checked with a straight-edge on wheels, made by Oscar Ansell & Sons, which shows any irregularities over 1/8 inch in height in 10 feet.

As soon as the slab had been accepted for smoothness by the inspector six men placed the Sisalkraft paper on the concrete. It was made up for this job in 100-foot rolls and kept on poles of 2 x 4's. An expansion fold of about 4 inches was left in one side to allow for the contraction of the paper after the concrete started to dry. Since the length of the roll is greater in a longitudinal direction and hence there is greater chance of splitting the paper in that direction it would seem well to provide contraction folds across the slab in each length of the paper. On other jobs that have been inspected where this paper has been used there have been many more patches of splits across the slab than along the slab, and many unpatched splits have been seen. It would seem advisable to leave a contraction fold across the pavement also. The same men who placed the paper also pulled the forms. The 2 x 4's on which the paper was rolled were used to weight down the paper at the 2-foot laps and then the laps sealed with sand. The paper was left on the slab for three days and then removed and the joints poured with asphalt joint filler material consisting of a mixture of 80 to 85 parts asphalt cement and 15 to 20 parts inert filler, by weight. No further curing was required.

When the burlap is first removed prior to the placing of the curing paper, the specifications require that in no case shall any concrete be left unprotected for more than one-half hour and therefore only 300 feet of the slab was uncovered at a time while the surface was being checked with the roughness machine. Then this section was covered with the paper and another 300 feet uncovered for checking.

Water for the mixing operation as well as for the sprinkling of the grade and the surface during the preliminary curing was provided by a triplex pump delivering creek water a distance of about 2 miles to a 2½-inch pipe. The valves for the paver hose were set in the line at 200-foot intervals. To increase the speed of shifting hose the contractor used a 12-foot length of paver hose with the full equipment to attach to the valve and with a Boss quick-acting connection on the other end. With two of these he was able to have one ready at the valve ahead and when it came time to shift the hose ahead no time was lost in making the connection. The paver hose was clamped to the grade planer to prevent any strain coming on the connection to the paver itself. When a short section of hose needed to be moved the man who handled the sprinkling simply set up a loop of the hose and rolled it ahead. This trick used by many contractors in the old days has seemed to be discarded with the short sections of pavement that have been permitted in contracts these last few years. Perhaps it is that contractors expect the hose to last one contract, long or short, and hence they have let the hose drag along the rough shoulder on the shorter jobs.

The concrete inspector for the state made test beams every 200 feet and these were broken at 3, 7, 14 and 21 days. Two beams were made in each mold. The pavement could not be opened until the beams showed a modulus of rupture of 600 pounds.

The Expansion Joints

Profiting by the experience of 1931 when there was an epidemic of pavement heaves from the heat, the Wisconsin engineers are installing expansion joints every 30 feet and eliminating contraction joints altogether, which after all is good sense for every expansion joint can act as a contraction joint but the converse is not true.

The expansion joints were made up of ½-inch premoulded material of the sandwich type with a double key plate of thin sheet metal on either side so that when the joint was assembled a cross section looked like a double cross. The joint was capped with an equal-leg cap reaching down to the top key. The expansion joints fit the thickened edge slab, which is 9 inches thick for the outer 12 inches, then reduces to 6½ inches uniformly in the next 2 feet and remains this thickness for the remaining 7 feet to the center line of the road.

Ten dowels in each one-half section measured ¾-inch in diameter by 24 inches long. These were painted with one coat of red lead, oiled and 6-inch metal sleeves placed 4 inches on the side toward the paver. A single transverse bar was placed on each side 8 inches from the joint and wired to the dowels. This bar ran to within 3 inches of the forms on either side. A standard machine was used for setting the assembled joints. There are two types in use in Wisconsin and this contractor used one and then the other. The first has a bar which has hooks attached so that when the bar is pulled out it holds the dowels in place. When the joint is in place and the concrete placed around it the bar is sledged at the end and the dowels released. The second type has individual hooks with individual levers on each side for releasing the dowels. These do not require such heavy blows and therefore there is not so much chance of moving the entire joint when the dowels are released.

Center steel for the pavement, placed on the concrete struck off by the special unit 9 feet behind the grade planer, consisted of two round deformed bars 8 inches on either side of the center joint with 40 inches overlap. Transverse bars were wired to these bars every 2 feet and the whole assembly installed so that the transverse bars come into the center of the slab. Two men assembled the joints on the shoulder and the two men on center steel assisted in putting the joints in place with the installing machine.

Personnel

This FAP 325-A & B, 7.408 miles of 20-foot pavement on a 40-foot grade, was awarded to the Universal Engineering Co., of Medford, Wis., for $153,028.95. F. G. Pierce, President and General Manager of the company, was in personal charge of the contract with A. J. Perkins as Assistant Superintendent. Gus Wasserman was Concrete Foreman. For the Wisconsin Highway Commission, A. M. Spooner was Resident Engineer.

Limited Finances Curtail Work in Clay County, Ks.

Because of limited finances, the 1937 program of the Clay County, Kansas, highway department was small. In cooperation with the WPA, 4 miles of salt-stabilized surfacing was constructed as well as 3 miles of bituminous mat surface. The county crews graded about 15 miles of road with blade and elevating graders.

The total funds of the county, including the gas tax, are $48,000 for maintenance and construction, according to Maloy Quinn, County Engineer. There are 172 miles of county roads and 1,097 bridges over 5-foot span.

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at less cost per mile

The Littleford No. 101 will enable you to maintain your roads in better condition than with any other method. Use any type or grade of road bitumen you please. Do pot hole patching, shoulder dressing, skin patching, surface treatment or penetration work. Use one or two hand-sprays or the spray bar on rear. Big enough for one load to last all day. Save on cost by using bulk material. Write for prices and full particulars now.

Ask for Bulletin K-5.

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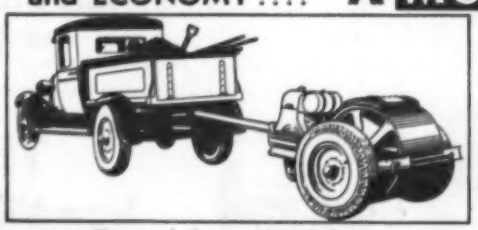

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On the Job a Self Propelled Roller

The WHEELED ROLLER Corp. ★ SAN ANTONIO, TEXAS

New Traffic Tunnel For Rotterdam

(Continued from page 23)

bracings must be lacking on account of the space required for the through traffic and ventilation chambers.

Moreover, the opponents to the project consider it a disadvantage that the ventilation channels in this type of tunnels will have to be installed in the sides of the structure instead of in the bottom and top parts as in the case of tubular tunnels. Several other risks were mentioned in these articles, such as the final joining of the under-water sections, increased weight and similar detriments. It is also said that although the tunnel is to rest on a layer of sand to be forced underneath the structure by means of pressure, this part of the work can not be checked properly and that torsion might occur at places which do not happen to be properly supported.

The Rotterdam Department of Public Works, however, is of the opinion that the project is thoroughly reliable and practicable and is reported to have assumed full responsibility for it.

Cost of Construction

The tunnel is estimated to cost 14,919,900 guilders or about $8,169,690. This amount will have to be increased by $202,601, if it should be found necessary to use connecting caissons, and by an additional percentage because of increased prices.

The contract for this tunnel, to be built according to the original plans for a tubular tunnel, was awarded on February 2, 1937 to five contractors who have formed a separate limited liability company for this project, known as N. V. Maastunnelbouw (Maas Tunnel Construction). This contract however included a clause allowing for changes in plans as well as a stipulation that the basic price is to be increased by a "fair" percentage because of exceptional circumstances. The cost of the present project exceeds that of the one originally planned by $390,363 and its annual cost of operation and maintenance will be about $24,093 more.

Financing

For the construction and equipment of the tunnel and for the necessary improvement of roads leading to the tunnel, the Government will advance 14,919,900 guilders to the municipality. At the present rate of exchange, that is about $8,000,000. The Traffic Fund, a fund drawing its income from road tax collections which are applied to the Government road and bridge construction program, will furnish 8,000,000 guilders, or about $4,400,000, and 6,000,000 guilders will be advanced from the Work Fund for unemployment relief. The first 8,000,000 guilders will have to be repaid with interest not earlier than 1948 in one sum or in forty annuities beginning not earlier than 1948. The 6,000,000 guilders will have to be repaid with interest in forty annuities beginning in the year the tunnel is opened to traffic.

The material for this article was furnished by the American Consul at Rotterdam through the U. S. Bureau of Foreign and Domestic Commerce.

A P & H Bantam Weight Mounted on a Truck Removing Snow Drifts from a State Highway

Year-Round Shovel Does Winter Duty

The P & H Bantam-Weight shovel, which with its standard 3/8-yard bucket is adaptable to excavating, grading and similar work, can be equipped with a special 1½-yard snow scoop for removing snow from the highways. This scoop is made of special alloy steel and will deposit the snow from 12 to 15 feet beyond the road's edge.

Last winter one of these snow shovels cut through ¾ mile of tough Wisconsin drifts from 3 to 10 feet deep through snow banks hardened by previous plowing, clearing a two-lane highway with all snow spoiled well off in the ditch, in 6 hours, according to the manufacturer.

Complete information on this P & H Bantam-Weight, as well as on P & H snow plows, may be secured direct from the Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis.

Road Curves

A practical treatise on road curves for safe modern traffic and how to set them out, by F. G. Royal-Dawson, late Professor of Roads and Railways at the Royal School of Engineering in Cairo and formerly Chief Engineer and Director of Civil Engineering for the Indian Railway Board, has been published in this country by the Chemical Publishing Co. of New York, Inc. "Road Curves," which is a sequel to "Elements of Curve Design for Road, Railway and Racing Track" was prepared for the guidance of all those who have to deal with the improvement of existing curves and the location of new roads as well as for students of highway engineering.

The book contains a large number of tables and formulae, the latter being given in metrical as well as British units. Higher mathematics have been excluded from the body of the text and also in the Appendix, except in a few cases to show how certain formulae were arrived at. The tables have been arranged to reduce calculation to the minimum.

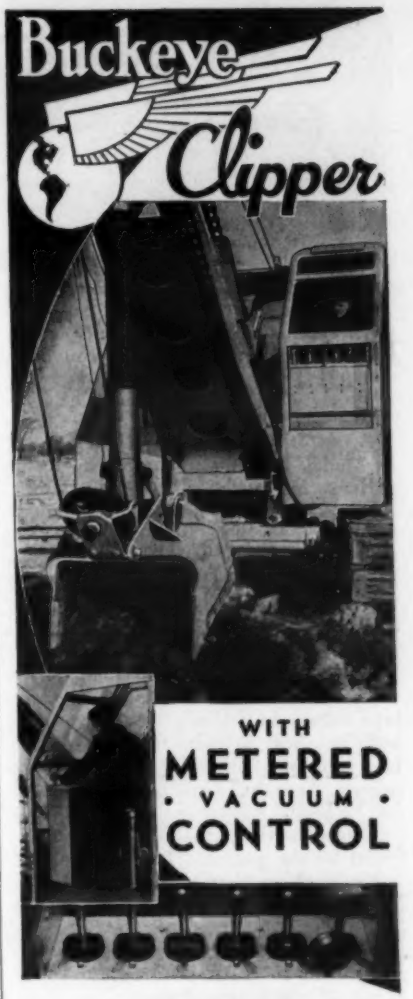
Copies of this book may be secured in this country only from the Chemical Publishing Co. of New York, Inc., 148 Lafayette St., New York City. Price: $3.50.

Kapok Vests Prove To Be Life Savers on Many Jobs

When working around deep water, many lives have been saved by requiring the men to wear kapok vests, while fatalities continue to occur due to the omission of this safeguard, the *News Letter* of the Construction Section of the National Safety Council reports.

Many men think that wearing such vests makes them sissies, or complain of lack of freedom in doing their work when wearing one. There really is little interference due to the new type of vest, either in cold or warm weather, and it is better to be a live sissy than a dead "heman." A good swimmer needs to wear one as well as one who can not swim, as often a man falls against some object and is unconscious when he hits the water. With a vest on, he comes to the surface more quickly and a rescue is possible, even though he has drifted some distance from the place where he fell in.

Men have been known to fall overboard for no apparent reason—perhaps a sudden loss of balance or lapse of consciousness. He may be hit by a falling object and fall in. Greater danger exists when a man is working alone or at night on a floating plant or at the water's edge. A foreman is responsible for the safety of his men and it is he who should determine when and by whom a kapok vest is to be worn and it is his duty to see that his orders are obeyed. Don't let it be said that through your neglect a life has been lost. Such a stigma is carried to the end of your days.



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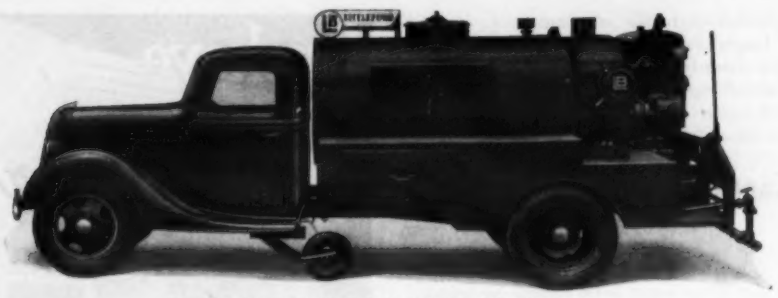

The New Littleford Model TS Distributor

New Distributor Handles All Types of Road Bitumen

A new bituminous distributor, known as Model TS, in sizes of 500 to 2,000 gallons, for truck or trailer mounting, insulated or plain, has been announced by Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio. This new distributor handles all types and grades of road bitumens and is designed for heavy-duty construction service.

The heating system consists of two large LB torch burners, each of which fires directly into a 6-inch diameter U-type return heat flue. Burners provide sufficient heat to raise the temperature of a tankful of material 3 degrees F. a minute. Less than one-third of a tankful can be heated safely.

Control of the pumping system is governed by the patented Littleford single valve, such as that used on Model C. With the control hand-wheel set at "Spray," the full pressure of the pump produces instant action at the nozzles. By shifting to "Fill" position, the spray is cut off instantly and there is no dribbling at the spray bar because the full suction of the pump sucks back into the tank all material in the lines. To aid in heating, the hand-wheel may be set at "Circulate" and the pump draws hot material off the bottom, putting it back in on top without passing through the manifold bar. A powerful engine and positive 300-gallon Viking rotary gear-type pump produce the amount required at the spray bar. The pump and fifth wheel tachometer gage the application accurately and thermometers register the application temperature. Any rate of application, from 0.1 to 2 gallons per square yard with spray bar lengths up to 24 feet, can be had.

The pumping system of piping is simple. The engine mounting is crosswise, with all accessories easy to reach. The operator's platform is high, to give him full vision. The framework fits any standard truck chassis, without alterations.

A new Bulletin M-17, containing full details on this new bituminous distributor Model TS, may be secured direct from the manufacturer.

A Five-Year Road Plan For Union of South Africa

Although the first year's work on the Union of South Africa's program of highway improvement which was begun in April 1936 did not quite reach the scheduled 1,000 miles, satisfactory progress was made and it is expected that 2,000 miles will be completed by April 1938.

The National Roads Board's plan proposes the construction of 5,396 miles of main roads by March 1941. The schedule for 1937 calls for an additional 1,000 miles. The details for the 1937 work are not all available, but the U. S. Bureau of Foreign and Domestic Commerce reports that the Board is planning as far as possible to spread the work equitably over the main routes throughout the Union. Eventually the finished sections are to be linked up until all of the main thoroughfares are improved. Exclusive of equipment and bridges, it is estimated that the cost of improvements over the whole system will average around $5,000 a mile. The total estimate for plant, bridges and construction is about £8,314,800 or about $41,574,000.

The greater part of the National Board's income is from the gasoline tax and the rest, which will amount to approximately £4,000,000, will be borrowed. The current financial year's allocation for 1,000 miles of road, including plant and bridges, is over £1,600,000, this being about £100,000 more than for the 1936 fiscal year ending March 31, 1937. For each year thereafter the annual expenditures are to increase until for the fifth year ending March 31, 1941 the amount will be £1,800,000. The deficit each year will be met by a loan. The income is expected to rise each year as the number of motor vehicles is increasing and the increase will, no doubt, be accelerated by the provision of good roads, according to a report in *Roads and Road Construction.*

Belts for Conveyors Or Power Transmission

Scandinavia solid woven cotton belting, made in a variety of weaves, for use on conveyors or for power transmission is described and illustrated in a new manual and price list "Scandinavia Belting" recently issued by the Scandinavia Belting Co., 248-250 Central Ave., Newark, N. J. In addition the booklet contains valuable information on the type of belting to use to meet safely various job requirements, on belt joints, and on the care and maintenance of belts.

Copies of this 32-page booklet may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

Lighting Bibliography Prepared by U. S. B. P. R.

A bibliography on highway lighting, covering primarily the years 1913 to 1936, with emphasis on the more recent developments, has been prepared by the U. S. Bureau of Public Roads for the benefit of highway engineers and city officials. The latest developments in lighting streets and highways, bridges, viaducts, tunnels and causeways, as well as material on new types of lamps and control systems, are included. The references are arranged according to the time of publication under each of the years, with a collective author index at the end. Articles in French, German, Spanish and other languages, as well as in English, are listed.

Copies of this bibliography, Miscellaneous Publication No. 279, may be secured gratis from the U. S. Department of Agriculture, Washington, D. C.

New Engine Plant for International Harvester

The general contract for the erection of the new $4,000,000 truck engine plant of the International Harvester Co. in Southeast Indianapolis has been awarded to the J. L. Simmons Construction Co. of Indianapolis, Ind. The contract includes the excavation, concrete and brick and other phases of the work for the principal factory buildings.

Work will begin at once and it is estimated that between 200 and 300 men will be employed on the project. The contract calls for completion of the principal building by December 15.

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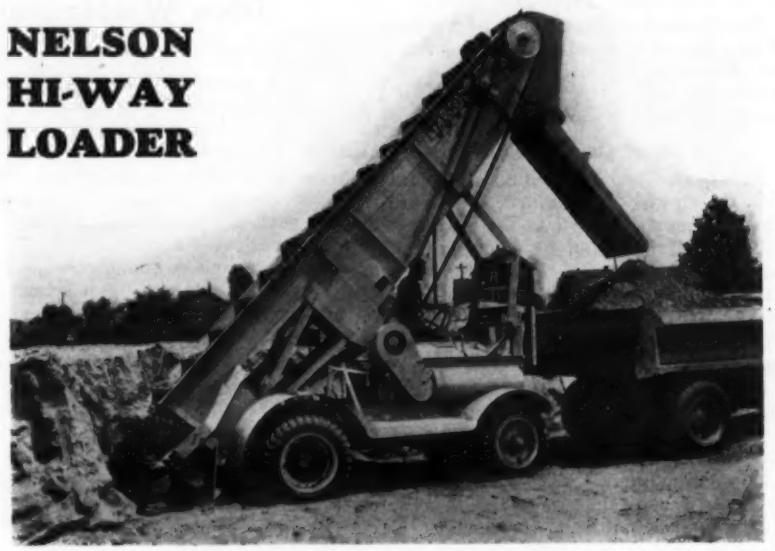
NELSON HI-WAY LOADER



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Runs twelve miles an hour.
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The 3½-T Mixer is another of Lansing's rugged, dependable concrete mixers—fast on the job, better production and better profits. Hyatt roller bearing wheels; large fast mixing drum; Alemite fittings; 2 H. P. Lauson gasoline engine—and other dominant features that will make the 3½-T your best mixer investment.

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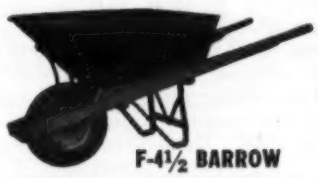


F-4½ BARROW

Deep tray, easy loading or dumping; Never-slip type axle 16" wheel with ball bearings; strong, reinforced frame; hard wood handles; channel-iron legs. Capacity: 4½ cu. ft. (dry measure). Ask for Bulletin L-12 and costs.

K-4 CONCRETE BARROW

Pneumatic-tired—handles 4 cu. ft. wet concrete, 6 cu. ft. dry material—round bottom bowl—easy dumping, easy handling. Ask for complete data, etc.

Grading in Canyon On Calif. Road Job

(Continued from page 20)

The third rock cut, about 3 miles from the east end of the job, also had a vertical face and was handled the same as the second cut. A Marion 450 shovel loaded out of this cut to two Dumptors as the haul was short. This cut encroaches on the river for a distance of 400 feet and it is the curve in this side-hill cut that made it impossible to see that just around the bend is the meadow land where work was handled by elevating grader.

Pneumatic Equipment

The air compressor equipment and the jackhammers used included a 360-foot Schramm portable unit, a 110-foot Ingersoll-Rand portable, and a 400-foot Gardner-Denver vertical compressor with a trailer mounting. The contractor used Timken detachable bits from 2⅝-inch to 1⅛-inch gage. The bits were ground in the contractor's own shop in Pueblo. A total of about fourteen Gardner-Denver jackhammers was used on the job. The best speed made in the hard pink granite was 35 feet in 6½ hours, using the 2⅝-inch bit in a jackhammer.

Elevating Grader Work

For 3 miles of this contract the grade was placed either by casting or loading from roadside borrow pits to a fleet of from six to twenty Ford, Chevrolet and International trucks all owned by the contractor. The grader was an Austin-Western power grader with a 42-inch belt and was pulled by a Caterpillar Seventy-Five diesel tractor. Along one section the grader worked successfully for the top 2 feet of the cut in the borrow from the shoulder and then it hit water and the borrow had to be completed with draglines. A Universal truck-mounted 1-yard dragline and a Marion gas-electric dragline of the same capacity were used on the wet borrow and also for the excavation of the selected material.

On backslopes a Cletrac and Galion No. 12 grader did most of the work and also rounded off the tops of all the backslopes so that the unsightly top line of sod was eliminated and the grass permitted to grow naturally over the edge and work its way down the slope. This is a standard practice in Colorado that is to be recommended from the standpoint of appearance.

Gravel Surfacing

The contractor produced the gravel surfacing in a pit about 3 miles average haul from the road and located on the old main road. The Universal dragline was used to load two shuttle trucks which hauled to the 6-inch railroad rail grizzly over a reciprocating feeder delivering to a 15-inch belt conveyor. This led to the one piece Cedar Rapids 9-24 screening and crushing plant, driven by a belt from a trailer-mounted Waukesha power unit, which delivered the finished material to the bins of an old Blaw-Knox batching plant which was used for weighing the 9,000-pound loads for the Dumptors, two of which hauled the gravel to the road. This made possible the elimination of a large investment in a platform scales and the time lost in weighing the tare of each truck every time it was loaded. The loads for trucks was 6,000 pounds. All gravel surfacing was paid for by weight. The gravel was spread on the road by a Galion dual-drive patrol grader.

C. & E. M. Photo

There's More Than One Way of Holding a Jackhammer Down

Bridges

There were several bridges on the job, the largest of which is located at the east end. It is an I-beam structure with a concrete deck with seven beams to the span. There are two 40-foot spans and a 30-foot roadway. The hand-rail was cast in place in 12-foot sections, using a special metal-lined form. The center pier of this first bridge was placed on solid rock 8 feet below the stream bed.

There are also three 60-foot and two 30-foot bridges of similar construction on the contract.

Personnel

The Driscoll Construction Co. of Pueblo, Colo., contractor for this project, suffered a severe and sad loss through the sudden death of the two Driscoll brothers who were the principals of the company. Their deaths occurred within a month of each other. The work was carried on by the estate with Dan Ratliff in charge as Superintendent. For the Colorado State Highway Department, John W. Robertson, Resident Engineer, was in charge.

A New Small Ditcher

A smaller ditcher, to be known as Model 120, having the operating advantages of the larger Model 160 service ditcher, has recently been announced by the Buckeye Traction Ditcher Co., Findlay, Ohio.

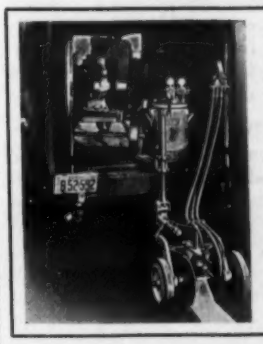
The main feature of this new unit is its shiftable boom which enables the machine to dig right alongside curbs, close to trees, poles, or other obstructions. This boom rides on two heavy steel tubes and is readily moved to either side or to any intermediate point, bringing the edge of the ditch to within 4 inches of the outside of the Alligator traction treads or within 10 inches of the overall clearance of the machine. The overall width of the machine is 6 feet 3 inches.

Another feature is the use of tubular steel boom construction. Two telescoping sections provide means of readily adjusting the boom for normal maximum cutting depths of 7, 9 or 11½ feet. Cutting widths range from 16 to 30 inches. A saving in weight has been effected by the use of 100 per cent electric alloy heat-treated steels throughout the machine. The bearing pressure on the Alligator treads is reduced to approximately 9 pounds per square inch.

Provision has been made for digging while the machine is tractioning backward, permitting tunneling under sidewalks, digging up to building foundations, cutting manholes, etc. Twenty selective gear speed changes forward and four in reverse give a choice of digging speeds from 2.6 to 89 inches a minute. Changing one sprocket doubles the speeds available.

The New Buckeye Model 120 Ditcher

Detailed information on the Model 120 is contained in a new bulletin which may be secured by writing direct to the manufacturer.



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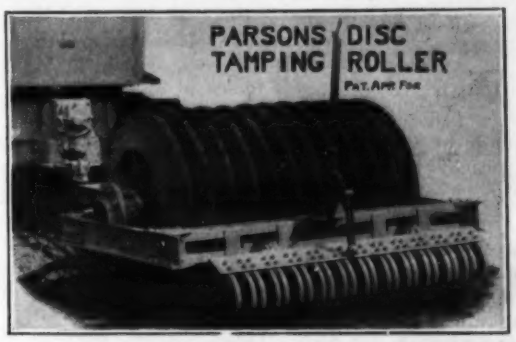

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Soil Mechanics Applied to Slides

(Continued from page 26)

material, inclination of the slipping plane, and the depth of the foundation failure. In the case of movement of a side-hill fill or a mass of earth moving on a slipping plane, sections show a more or less uniform movement of the entire mass, a depression at the top, and a bulge at the immediate toe of the slope.

In the case of settlement of a poorly consolidated embankment and an embankment constructed on a poorly consolidated foundation, sections usually show a deficiency of material when compared with the original constructed slopes, and no place where the ground line is outside the original. When sloughing has occurred, sections usually show the soil to be moving with different degrees of intensity at various places of the area in question.

Geological Log

The additional information obtained by a geological log proves very helpful in the solution of many slides. Such a log should be made by an experienced geologist, well versed in any geological irregularities of the area in question. In Ohio, landslides are very prevalent in the eastern portion of the State but occur only occasionally in the western portion. This may be explained largely by the fact that the prevalent landslide areas in the eastern portion are hilly and consist essentially of coal with under-clay, clay, and clay or silt shale, with some sandstone and limestone, all of the Pennsylvania system. The worst soil conditions in this area, as well as the entire state, are found in the Conemaugh out-crop with its deep beds of clay and clay shale. This formation can almost be traced by the scarred hill sides where landslides have occurred.

Sampling

After making a reconnaissance of the general locality, the slide should be thoroughly inspected and then divided into a number of different areas for sampling purposes. It is preferable that these areas be located as nearly as possible on cross section lines so that the results of drilling and testing can be plotted on the cross section sheets.

Auger samples should be obtained from each designated area through the unstable material or until rock is encountered. A 6-inch post-hole auger with 4-foot extensions made of 1-inch pipe has served quite satisfactorily for soil drilling on Ohio projects. The author has drilled to 40-foot depths with such equipment. Samples should be taken for each 4-foot vertical depth or at each change of material, placed in pint jars and sealed. Samples are tested in the laboratory for water content, mechanical analysis, and other physical characteristics necessary to classify the soil.

In cases where exceptionally deep drilling becomes necessary, where rock is encountered, or where the establishment of a definite foundation of rock is necessary for the use of piling, core drilling constitutes the only means of obtaining this information.

Density samples should be taken and weight per cubic foot determinations made at several of the designated sampling areas. This is accomplished by excavating a bench, drilling a hole with a 6-inch auger and filling the hole with dry sand of known weight per cubic foot. After the volume of the hole has been determined the weight per cubic foot of the material can be calculated. This figure should then be compared with the laboratory maximum weight per cubic foot determination.[1]

Some Causes of Ohio Slides

After extensive investigation and inspection of many large landslides in Ohio recently, five general types of slides have been found. Although combinations of two or more of these types are present many times, the recognition of the possible cause of the slide will often simplify the field procedure. That all slides are not moving on slipping planes is indicated by the following descriptions of these slide types.

Unconsolidated Soil

The creeping or sloughing of soil in embankment or cut after periods of saturation can many times be attributed to poor consolidation. This condition usually exists when clay or shale is the chief constituent of highway embankments or hill cuts.

The physical characteristics of most clays indicate a condition susceptible to sliding and instability. The sliding clays are those with high-water-holding capacity and high in cohesion, measured in the laboratory by the liquid and plastic limit tests. Laboratory density tests show such clays to have a dry weight density of 100 to 110 pounds per cubic foot. When the toe of the slope of saturated unconsolidated clays is removed, equilibrium is disturbed and sliding results. In addition, when this same material is used in embankment and is placed at a density appreciably under the laboratory standard, sloughing and sliding results immediately after saturation. On the other hand, if such material is placed at a density near the laboratory standard, the volume of the air voids is so small, usually under 10 per cent, that stability is not greatly impared even when the soil is completely saturated.

(Continued on next page)

[1]Reference is made to an article by K. B. Woods, "Soil Mechanics in Highway Construction," January, 1937, issue of *Civil Engineering*, for the detailed laboratory density testing procedure.

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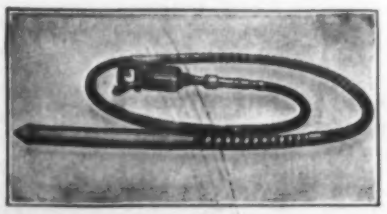
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Soil Experts Study Slides in Fills

(Continued from preceding page)

Unsuitable Material

Unsuitable material may be considered as the highly expansive clays and organic silts. When tested in the laboratory such materials are found to have an exceptionally high-water-holding capacity and to be low in cohesion. Density determinations usually show these materials to weigh something less than 100 pounds per cubic foot dry. Furthermore, from 25 to 35 per cent of water by dry weight of soil is required to obtain even this density, leaving something over 10 per cent by volume of air voids when compacted at the maximum.

It is significant to note that soil is said to be in a state of plastic flow when the moisture content exceeds the plastic limit. This moisture content, the plastic limit, is easily exceeded in such low density soils even when ideally compacted, and accounts for their unsuitability.

Settlement

Many embankments show evidences of a typical landslide after periods of inundation, moving both laterally and vertically, taking out the berm and guard rail, and in some instances the entire pavement. When such problems are encountered in high embankments, particularly in shale areas, settlement may be suspected.

Probably one half of Ohio's 4,500-foot geological column consists of shale. It is, therefore, one of our most common embankment materials. The danger in the use of shale lies in the fact that, when first cut, the material appears very much like rock. However, after a few months or years of weathering, the shale disintegrates to its constituent parts of silt, clay, or sand, which causes a great amount of settlement during periods of saturation.

Side-Hill Fills

In hilly country where side-hill cuts and fills are necessary, what often appears to be a typical landslide is actually a constructed embankment sliding on a steep original ground line. Improper drainage and the presence of organic material often facilitate such movement. The use of unsuitable material, poorly compacted shale, or clay containing a considerable quantity of large pieces of rock, will facilitate such movement by permitting water to percolate readily through the embankment.

Slipping Plane

In all parts of eastern Ohio where coal outcrops are prevalent or where clay shale is abundant, slipping planes often develop along inclined surfaces after becoming lubricated with water. After some movement has taken place, cracks develop, thus permitting additional water to enter and the slide gets steadily worse. However such slides often involve immense quantities of material, particularly where the sliding plane is deep. In addition, movement is normally slow and comparatively uniform, usually increasing in intensity in the spring or early summer after periods of heavy rain fall and floods. It is obvious that a thorough investigation of such a project is absolutely essential before any consideration is given to the possible correction.

Conclusions

In conclusion it is to be noted that a new idea is being formed in the analysis of landslides, namely, that the physical characteristics, state of density, and moisture content play a considerable part in landslides and unstable embankment. This new idea is based on the results of thorough investigation of several slides in Ohio and may be directly attributed to extensive laboratory testing and research. It is also significant that in our experience, once the cause of a slide has been definitely established by a thorough investigation as outlined above, there is usually little argument concerning a correction procedure for any one given project. It is obvious, therefore, that the continued development in soil mechanics will pay big dividends by definitely establishing the cause of failures.

Westwood Joins Culvert Dept. Of Wheeling Corrugating Co.

Announcement has been made by the Wheeling Corrugating Co., Wheeling, W. Va., of the appointment of Edward L. Westwood as Manager of the Wheeling Culvert Department. Mr. Westwood, who was formerly with the Wheeling Metal & Mfg. Co., will make his headquarters at the general office in Wheeling.

A New A-W 5-Yard Tractor Scraper

New 5-Yard Tractor Scraper

A new model of the 5-yard A-W tractor scraper, the features of which increase the ease and speed with which it loads, has recently been announced by the Austin-Western Road Machinery Co., 1815 Barrows St., Aurora, Ill. Like the earlier model, this new scraper uses but one cable and one lever to control all loading, carrying and dumping and is designed to work with any tractor ranging from 35 to 60 hp.

Adjustments have been provided for varying the clearance under the machine and the front door is so constructed that the pan will always get a full load. Several of these machines are already in operation and users have reported capacities up to 60 yards of pay dirt an hour.

A new bulletin, No. 1680, containing illustrations and a complete description of this new unit may be secured by those interested direct from the manufacturer.

Testing Machines Bulletin

A new 44-page bulletin on Southwark-Emery testing machines for testing the tensile strength of steel and the compressive strength of concrete cylinders has recently been issued by the Baldwin-Southwark Corp., Philadelphia, Penna. This new bulletin contains detailed descriptions and illustrations of the complete Southwark-Emery line of physical testing equipment.

Copies of this Bulletin 131 may be secured gratis by those interested direct from the manufacturer by mentioning this magazine.

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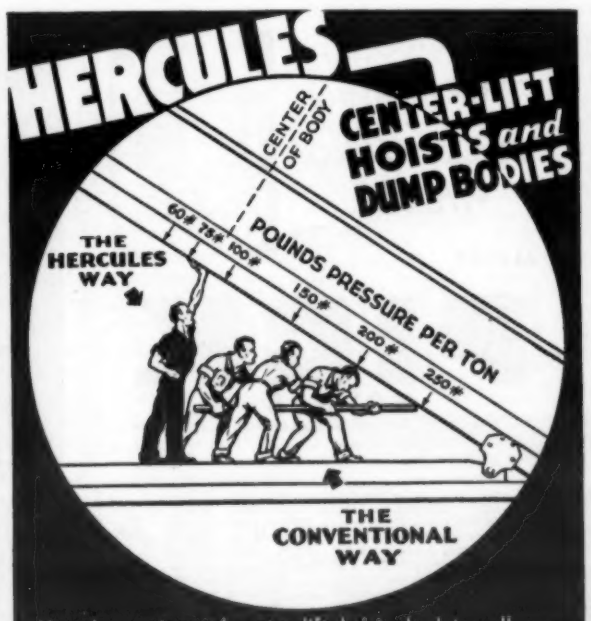

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C. & E. M. Photo

Concreting the 5 x 10-Foot Box Culvert Near the West End of the Job

Accounting System Featured W. Va. Job

(Continued from page 2)

dipperful of material ready to drop into the wagon as it was spotted. A Caterpillar Sixty gas tractor with a Euclid bulldozer and a new Adams patrol grader kept the material spread and to grade.

Other equipment that kept the job running included a 1½-ton Ford service truck with flat body, another 1½-ton Ford with a dump body to handle aggregate and cement, a Caterpillar Twenty for moving drilling equipment, pulling stumps and other odd services, and a Linde welding outfit.

Fills of dirt were spread in 12-inch layers and 2 feet layers of rock with a minimum of 2 feet of earth over any rock fill.

The Drilling Outfit

The power producers for the drilling crews included an I-R 320-foot portable compressor, an I-R 220-foot compressor, a Gardner-Denver 110-foot portable, and the holes were drilled with four Gardner-Denver jackhammers and an I-R wagon drill. Timken detachable bits were used throughout with 2½-inch bits for the wagon drill and 2¼-inch on the 16-foot jackhammer steel down to 1⅛ for the bottom of the holes. Atlas 40 per cent gelatin dynamite was used for the wet holes and ammonia dynamite for the dry shooting. The explosives were stored in a wooden magazine.

Office and Service Buildings

A small office was provided on skids for easy moving and was equipped to take care of the state engineering staff and the contractor's bookkeeper. A small section of this building had sleeping quarters for the partner who was running the job. Another similar portable knockdown shack was set up as an office for the foremen.

An oil house, "about the most important building on the job" according to W. L. Pinnell, housed the greasing equipment and the drums of Standard Oil of New Jersey Essolube lubricants on which the contractor standardized. A supply house had bins and racks for all parts that might be needed on the job and a tool house provided a place for all hand and small tools to be stored at night and when not in use. Seven Linde Carbic floodlights were spotted over the job to permit the most efficient work as light failed on the last shift. The job was run for 20 hours a day with three 6-hour, 40-minute shifts.

Quantities

Clearing right-of-way	17,700	linear feet
Unclassified excavation	250,000	cubic yards
Overhaul (1,000 feet free haul)	20,000	station-yards
Structural excavation	1,900	cubic yards
18-inch paved invert Armco pipe	500	feet
18-inch reinforced concrete culvert pipe	1,500	feet
24-inch reinforced concrete culvert pipe	75	feet
Class A concrete (1:2:4)	840	cubic yards
Class B concrete (1:2½:5)	150	cubic yards
Stone masonry	240	cubic yards
Reinforcing steel for structures	185,000	pounds

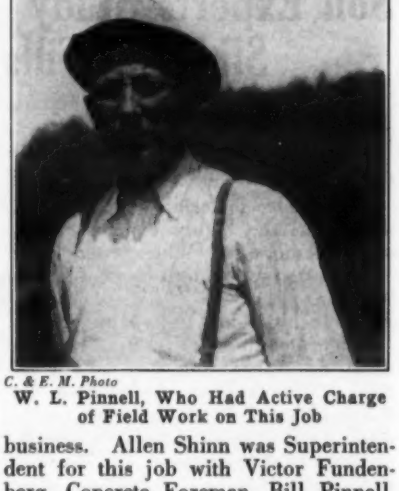
Accounting

"When a job is completed, and at any time during its progress, I want to know just what every operation, every pipe culvert, every day's excavation, every foot of hole drilled costs," said Mr. Pinnell, "and I have a simple complete accounting system that starts right in the field with reports from every foreman. Every day the reports are summarized by our field bookkeeper and then sent to the home office in Ripley, W. Va., and the book that has the summaries of all our jobs is seen by no one but ourselves."

These daily reports of the foremen include a detailed report from the mechanic at the tool house and oil house and shows just what has been used for lubricating and fueling each shovel, tractor, truck, compressor, and touring car; then there is a card for the daily clearing of right-of-way, another for the grading foreman to use, another for the foreman in charge of installing drainage structures, still another for drilling and shooting, and finally one for finishing shoulder. We are privileged to reproduce the daily drilling and shooting report as typical of the detail in which the reports must be made out. The reverse of the card shows the names of the employees working on that operation during the day with the number of hours worked and the type of work. Then at the bottom of the back of the card is space for "General Information" such as weather conditions, reasons for delays, etc.

Personnel

The contracting organization of Pinnell & Pfost consists of W. L. Pinnell, who handles the construction and field work, and W. M. Pfost who handles the financial work at Ripley, W. Va., where the contractor also operates a lumber business. Allen Shinn was Superintendent for this job with Victor Fundenberg, Concrete Foreman, Bill Pinnell, Grade Foreman on one shift and Sam McGrew, Grade Foreman on the other daylight shift, and John Rhodes, Powder Foreman. Paul Ewing was Inspector in Charge for the State Road Commission of West Virginia, of which Mortimer W. Smith is Chief Engineer.



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W. L. Pinnell, Who Had Active Charge of Field Work on This Job

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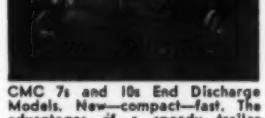

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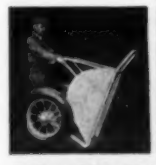

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Replacing Culverts With Pervious Fills

New Means of Preventing Slides Where Seepage From Rocky Slopes Might Weaken Stability of Fill

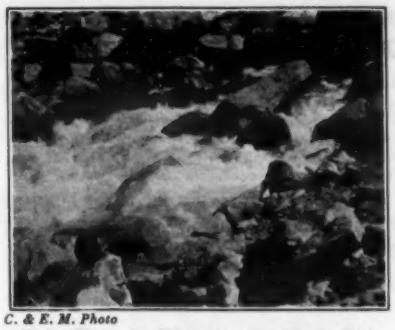
IN a country where there is seepage from the bed rock on which sidehill fills of earth have to be made, there is danger of slippage of the fills due to saturation at the plane of contact with the bed rock. To overcome this, California, where slides have to be guarded against on most highway construction, has tried a new method of building fills. The bottom course is constructed of the rock taken from the adjacent cut, using the largest rock at the bottom and gradually raising the embankment with the smaller material. This provides a lower course of embankment of open texture suitable for drainage, permitting water to escape without doing damage as there is no earth to be washed out at that depth.

On many sidehill fills this has worked to advantage in permitting the omission of long culverts built on a steep slope, where the amount of water that must be cared for is very small. Of course in the development of this method there have been one or two errors and pervious fills built where water has accumulated so rapidly after an unusual storm as to wash out the entire fill. In most cases however, where this condition might possibly be created by a cloudburst and the drainage area would be sufficient to cause any possibility of trouble, a culvert has been installed.

Fill in Feather River Canyon

One of the most interesting of the pervious fills is on the highway being built in the Feather River Canyon. Here a stream of fair size flows past the entrance of one of the tunnels and enters the Feather River. There was considerable discussion among the location engineers as to whether there should be a bridge, a large culvert, a pervious fill or a diversion tunnel. The two latter were combined and make an interesting combination for the study of pervious fills, for the stream flow can be readily measured at a point not far from the fill on the upstream side and the diversion tunnel is ready to take care of any unusual flows.

It is a bit startling to the uninitiated to come upon a fill with a large stream of water gushing from the base and with no evidence of a culvert, past or present. The illustration showing the fill at the entrance to one of the tunnels on the Feather River Project will bear this out. Here some 150 feet per second is flowing through the rock at the base of the fill with no evidence of damage to the fill. The photograph does not show the diversion tunnnel which is about 20 feet above the bottom of Grizzly Creek at the site of the fill. The rock in the base of the fill ranges from 1 cubic foot to 1 cubic yard in size and is a good quality of granite. The diversion tunnel has an area of 15 x 15 feet.



C. & E. M. Photo

This Flow Is Through the Rock Fill And Not Through a Culvert

Tandem-Drive Axle Unit

The Timken SBD-1000 and 1500 tandem-drive axle units for six-wheel trucks with bevel gear drive and inter-axle differential, made by the Timken-Detroit Axle Co., Detroit, Mich., are self-contained hookups of two driving axles with load-equalizing spring suspension and torque rods. The bevel drive is used in both axles and embodies such features as Timken shock-proof gear mounting, four-pinion differential, three-bearing pinion mounting and full-floating axles. Power is delivered from the engine through a conventional transmission to the Timken torque-divider, which is rubber mounted on the cross member directly behind the transmission. Here the power is divided between two helical spur gear sets by an inter-axle differential, but not equally unless there is equal traction for each driving wheel. The Timken high-traction differential automatically compensates for the loss of traction of one driving axle by transmitting additional power to the wheels on the other driving axle having traction.

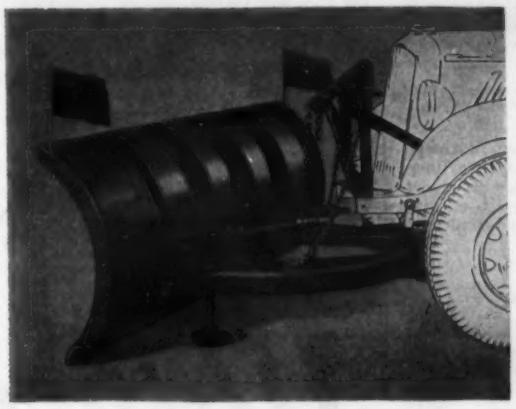
This unit is mounted on the main drive shaft and rides on two Timken tapered roller bearings. The power is delivered to the differential case, which divides the power between two side gears by means of four pinions. Each differential side gear is integral with a helical spur gear, and each of these in turn drives a second helical spur gear splined to a cross shaft. The positive alignment of these cross shafts is secured by four Timken tapered roller bearings. Each of these two cross shafts is directly connected by independent propeller shafts to a driving axle.

The power from the torque divider to the rear driving axle is transmitted by a propeller shaft to a short shaft, rigidly mounted on opposed Timken taper roller bearings in a journal mounting provided on top of the forward driving axle housing. The lubrication of this intermediate journal is automatic, accomplished by an oil inductor. From here the power is delivered by a second propeller shaft to the pinion shaft in the rear driving axle. This allows complete flexibility, permitting the rise and fall of the driving axles without any possible interference between the forward driving axle and the rear propeller shaft.

The load-carrying function of the SBD-1000 and 1500 series is performed by the vehicle springs. These springs, which are full floating, act as a balance lever between the two axles, and the frame lift, due to passing over obstructions, is cut in half because of the 2 to 1 ratio of the balance lever. While the spring ends are not attached to the axle, lateral movement of the springs on the axle is restricted by suitable brackets. The tractive effort of the driving wheels is transmitted to the chassis by means of torque rods arranged to form two parallelograms. When the vehicle moves forward, the forward driving axle pulls the chassis and rear driving axle pushes the chassis by means of the torque rod system.

Literature describing and illustrating the features of the SBD-1000 and 1500 series tandem-drive axle units may be secured by those interested direct from the manufacturer.

The American Association of State Highway Officials will hold its annual convention September 27-30 at the Statler Hotel, Boston.



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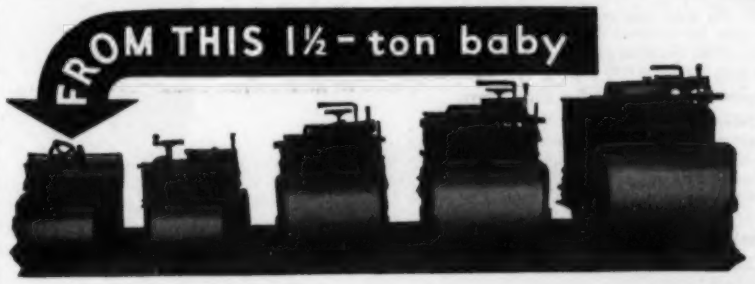

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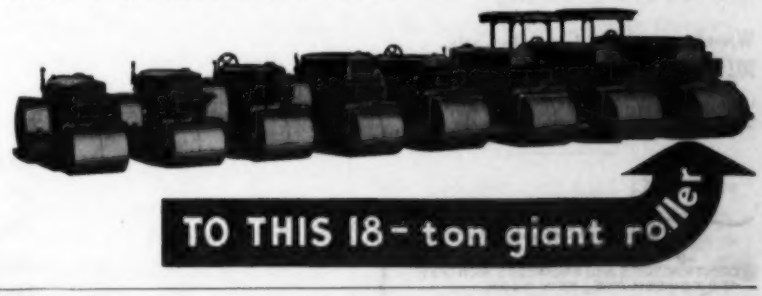

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V-Belt with Concave Side

293 The Gates Vulco V-belt with a patented concave side which is claimed to provide a full side-wall grip on the pulley without slippage, saving belt wear and power, is described in literature which the Gates Rubber Co., Denver, Colo., will be glad to send on request.

A New Bucket Loader

294 The improved Model 82-A bucket loader, a feature of which is the new design of spiral feed, is described and illustrated in literature which may be secured direct from the Barber-Greene Co., Aurora, Ill., by mentioning this magazine.

Mechanical Mixer Timelock

295 Hetherington & Berner, Inc., Indianapolis, Ind., will be glad to send to those interested complete information on its patented mechanical mixer timelock which operates off the mixer shaft and may be installed on any asphalt plant.

Pumps for Wellpoint Systems

296 Complete information on Novo pumps for use with wellpoint systems as well as for other pumping jobs on construction work may be secured by those interested direct from the Novo Engine Co., 216 Porter St., Lansing, Mich.

Plywood for Concrete Forms

297 Harbor Plywood Corp., Dept. CEM, Hoquiam, Wash., will be glad to send to interested contractors complete information on Super-Harbord Plycrete, a plywood for concrete forms which is claimed to result in a smooth surface, may be reused over and over again and is guaranteed against ply separation.

Concrete Vibrators

298 Complete information on Mall concrete vibrators, in a type and size for every concrete job with gas engine, air or electric power, may be secured direct from the Mall Tool Co., 7743 So. Chicago Ave., Chicago, Ill.

Oil Engines for Construction Equipment

299 Bulletin 918 describing Waukesha-Hesselman engines, which are low-compression solid-injection units burning low-cost diesel fuels, may be secured direct from the Waukesha Motor Co., Waukesha, Wis.

Mats for Concrete Curing

300 Cotton mats and burlap for concrete curing, as well as tarpaulins, windbreaks and anything made of cotton, are described in literature which the Fulton Bag & Cotton Mills, Atlanta, Ga., will be glad to send on request.

Bulletin on Bituminous Distributors

301 Bulletin M-14 issued by Littleford Brothers, 485 E. Pearl St., Cincinnati, Ohio, describes in considerable detail the new Model C Littleford pressure distributor for black top road work where tar, asphalt, road oil, cut-back or emulsion is used at the rate of 0.1 to 2.5 gallons per square yard through spray bars up to 24 feet long.

Wheelbarrows and Concrete Carts

302 Sterling Wheelbarrow Co., Milwaukee, Wis., will be glad to send to those interested complete information on its line of Sterling wheelbarrows and concrete carts.

Snow Plows for 1½ to 3-Ton Trucks

303 Austin-Western V-type and blade snow plows for mounting on 1½, 2 and 3-ton trucks, a feature of which is the hydraulic control, are described in literature which state, county and township highway engineers may secure direct from the Austin-Western Road Machinery Co., 1815 Barrows St., Aurora, Ill.

New Pump Catalog

304 A new catalog, No. 38, describing the complete Sterling line of pumps for every purpose, ranging in size from 1¼ to 10-inch, may be secured from the Sterling Machinery Corp., 411-13 Southwest Blvd., Kansas City, Mo.

Road-Building Equipment

305 The Heltzel Steel Form & Iron Co., Warren, Ohio, will be glad to send to those interested complete information on its line of road-building equipment, including bins and batchers, and street and road forms.

New Road Striping Outfit

306 The Binks No. 37 road striping machine with trailer-type mounting for attaching to the back end of a truck and which spray-paints the traffic stripe is described and illustrated in Bulletin No. 37RS which interested state and county highway engineers may secure direct from the Binks Mfg. Co., 3114 Carroll Ave., Chicago, Ill.

Road Asphalts

307 Complete information on Texaco asphalt for the various types of bituminous surfaces may be secured by interested contractors and engineers direct from the Texas Co., Asphalt Sales Dept., 135 E. 42nd St., New York City.

A ¾-Yard Shovel

308 Complete information on the Lorain-40, a ¾-yard all-round shovel, may be secured by those interested direct from the Universal Crane Division of the Thew Shovel Co., Lorain, Ohio.

Line and Surface Level

309 Information on the Sand's-Stevens line and surface level, a feature of which is its special construction which prevents accidental detachment from the line, may be secured by interested contractors and engineers from Sand's Level & Tool Co., 8631 Gratiot Ave., Detroit, Mich.

Waterproof Tarpaulins

310 Complete information on Diamond Brand tarpaulins which are proofed against water, rot and mildew may be secured by those interested direct from the Diamond Brand Canvas Co., 150 Greene St., New York City.

HIGH CAPACITY 4" PUMP

Self-Cleaning; high suction lift

Self-priming • Open type trash impeller • 4-cylinder engine • Spring Mounted

FIG. 420

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Bulletins and Pamphlets

(Continued from preceding page)

4-Wheel-Drive Trucks for Snow Fighting

311 Autocar four-wheel-drive trucks and their adaptability to use in snow plowing on state, county and township highways are described and illustrated in Section 9 of the new catalog on the complete line of Autocar trucks, copies of which may be secured without obligation direct from the Autocar Co., Ardmore, Pa.

Diesel Engines on the Job

312 Complete information on Hercules diesel engines in a wide speed range to meet the varying requirements of construction jobs may be secured by those interested direct from the Hercules Motors Corp., Canton, Ohio.

Vibrators for Concrete Pavements

313 Baily Vibrator Co., 1526 Weed St., Philadelphia, Pa., will be glad to send to those interested complete information on Baily vibrating screeds and rollers for concrete pavements.

Pneumatic Equipment

314 Worthington air compressors, rock drills, concrete breakers, diggers and tampers, designed to handle any requirements for air tools, are described in literature which the Worthington Pump & Machinery Corp., Harrison, N. J., will be glad to send on request.

New Catalog on Wellpoints

315 The new catalog "Pointed Wellpoint Facts" describing the Griffin wellpoint system for unwatering excavation and similar jobs may be secured by those interested direct from the Griffin Wellpoint Corp., 725 E. 140th St., New York City.

Electric Plants for Construction Jobs

316 Kohler electric plants in sizes and models to meet the varying requirements for electric current on construction jobs are described in literature which the Kohler Co., Kohler, Wis., will be glad to send.

Tractors on the Job

317 Complete information on Allis-Chalmers tractors and their many services on construction projects may be secured direct from the Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee, Wis.

Two and Four-Wheel Scrapers

318 Bulletins 2WS1 and 4WS1, describing and illustrating Bucyrus-Erie two and four-wheel scrapers, respectively, both models of which are claimed to offer high-speed low-cost dirt-moving performance, may be secured by those interested direct from the Bucyrus-Erie Co., South Milwaukee, Wis.

Rock and Gravel Plants

319 Bulletin G-1, a 24-page booklet describing and illustrating the complete line of Iowa rock and gravel plants in varying combinations and sizes to meet any job requirements, may be secured by those interested direct from the Iowa Manufacturing Co., Cedar Rapids, Iowa.

Hydraulic Bottomless Scrapers

320 Catalog No. 1540, describing and illustrating Blaw-Knox (Ateco) hydraulic bottomless scrapers in seven sizes for operation with tractors of 30 to 65 horsepower, and with capacities of 2, 3, 3½ and 4 cubic yards, may be secured by those interested from the Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Pa.

New Type of Drainage Pipe

321 Skip-Pipe, a new type of cast iron pipe made with a sloping cradle and operating by gravity flow for subdrainage and under drains, is described and illustrated in literature which the Dimick-Mosher Products Co., 120 Boylston St., Boston, Mass., will be glad to send on request.

New Control for Arc Welders

322 The new Hobart selective motor horsepower control and other features of Hobart simplified arc welders are described and illustrated in a new bulletin "More for Your Money" which may be secured direct from Hobart Bros. Co., Box CE-77, Troy, Ohio.

Blade and V-Type Snow Plows

323 Literature describing Warco V-type and blade snow plows for grader or truck mounting which are designed as powerful snow fighters may be secured by interested state, county and township highway officials direct from the W. A. Riddell Corp., Bucyrus, Ohio.

New Hauling Equipment Booklet

324 The Euclid Road Machinery Co., Cleveland, Ohio, will be glad to send to those interested a new booklet which they have issued recently, containing complete information on Trac-Truks, interesting photographs, and several records of performance on various large construction projects throughout the country.

Soil Testing Instruments

325 Catalog 37S-CE describing its line of soil testing instruments which meet A.S.T.M. standards as well as special designs such as used by the U. S. Bureau of Public Roads may be secured by interested highway engineers direct from the American Instrument Co., Inc., 8012 Georgia Ave., Silver Spring, Md.

1937 Models of Snow Plows

326 The Ross 1937 snow plows, of the one-way and V-type, in sizes for mounting on 1½-ton trucks up to heavy-duty units, are described and illustrated in a new catalog which the Burch Corp., Crestline, Ohio, will be glad to send on request to interested state and county highway engineers.

County Handles Tough Road Job

When Winnebago County, Ill., decided to widen a road just north of Shinland, Ill., preparatory to paving it, they tackled a job tougher than they had counted on. Subterranean springs and loose sandy soil combined to present a number of problems. Equipment was mired, operating speed cut down and for a time the job was abandoned entirely.

Recently work was resumed with two Allis-Chalmers Model LO tractors and three 7-yard Continental scrapers. The accompanying illustration shows the type of soil and some of the conditions under which these units are working.

With its own equipment, which includes five A-C Model LO tractors, one Model K, a Baker bulldozer, three Continental scrapers and two Adams graders, Winnebago County handles a good share of its road building as well as its regular road maintenance. A. R. Carter is County Engineer.

One of the A-C Model LO Continental Scraper Outfits Owned by Winnebago County, Ill., In Action on a Tough Road-Widening Job

Wire Rope Fastenings

An interesting history of wire rope and wire rope fastenings as well as a discussion of the importance of thoroughly dependable rope fastenings and a description of Crosby clips is contained in a new 20-page catalog CCB-2 recently issued by the American Hoist & Derrick Co., St. Paul, Minn.

Copies of this catalog may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

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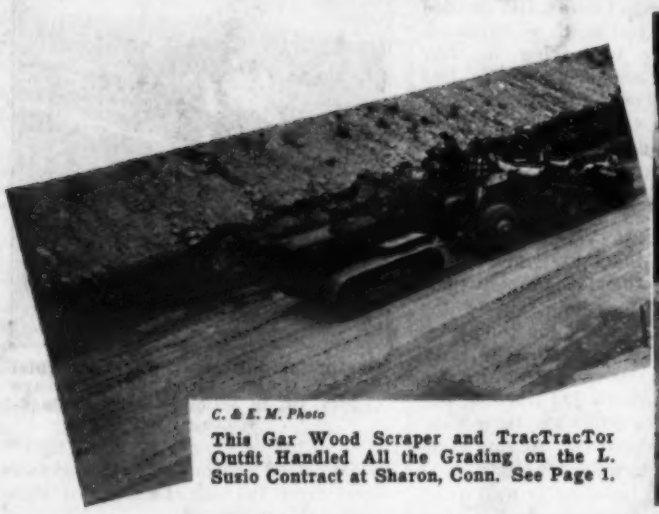


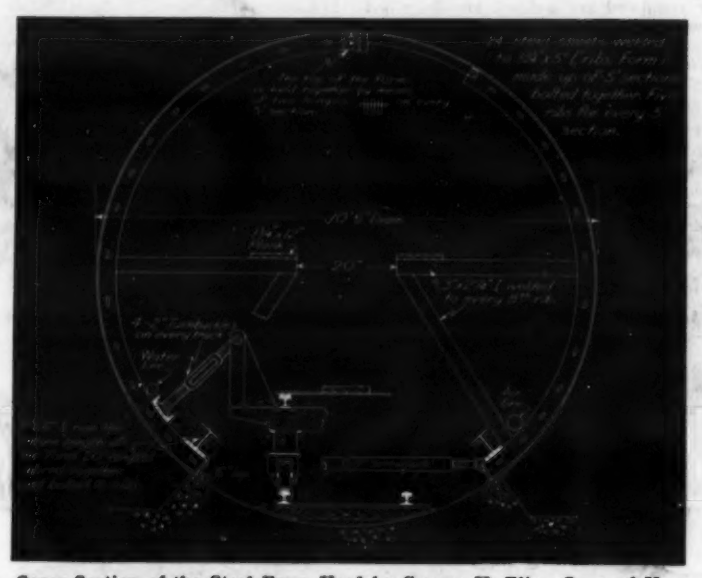
C. & E. M. Photo

This Gar Wood Scraper and TracTracTor Outfit Handled All the Grading on the L. Suzio Contract at Sharon, Conn. See Page 1.

C. & E. M. Photo

Brooming Dust from the Base Course (Left), and a Freight Car Over the Culvert Waiting to Deliver Stone to Trucks on the Suzio Job.

Snow Plowing in Eden Township, Fond du Lac, Wisconsin, Last Winter. This Township-Owned Snow Fighting Outfit Consists of a Wausau Snow Plow Mounted on an Allis-Chalmers Model L Tractor.



Cross Section of the Steel Form Used by George H. Flinn Corp. of New York City in the Construction of the Bronx Sewer Tunnel. See Page 11.

A Bros Sno-Flyr Plow and Wing on a Ford-Marmon-Herrington Truck, Owned by Hubbard County, Minn., and Shown in Operation Near Park Rapids in February, 1937. Photo by A. R. Taubman, County Hwy. Engr.

The Quack-Grass Digger Used for All Mixing Operations on a Cement-Stabilization Job in Adams County, Wisconsin. See Page 1.

Grading in North Carolina Foothills. A Lorain Shovel, Caterpillar Tractor and Athey Dump Wagon Owned by Chandler Bros.

Two Types of Equipment Used by the Maintenance Division of the Oregon State Highway Commission to Keep Its Roads Open During Winter Months. Left, a Pusher Plow Clearing the Columbia River Highway and Right, a Close-Up of a Rotary. See Page 1.

Oregon State Hwy. Dept. Photos